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COLLECTIVE REVIEW

ANTISEPSIS AND DISINFECTION IN SURGERY

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ALTHOUGH the application of drugs to wounds was practiced by the ancients, it was not until the classic work of Lister (43) that the full significance of bacterial infection in wounds was appreciated. Modern surgical procedures are based on Lister's observations that suppuration does not take place, provided access of bacteria from without is rigidly prevented. Oliver Wendell Holmes and Semmelweis, at an even earlier date, had concluded that puerperal fever could be prevented by aseptic precautions.

Lister achieved the elimination of infection from cases of compound fracture by the use of a crude carbolic acid, but not all attempts to prevent infection by this means were uniformly successful, and he later deprecated bringing this corrosive substance in contact with tissues (43).

Ever since the discovery by Pasteur of the bacterial etiology of infections, many substances have been recommended for their antiseptic or disinfectant properties. Each year finds many additions to the list (40). In most cases these represent efforts to provide an ideal antiseptic.

Antisepsis and disinfection are far from being simple subjects, and advances in our knowledge of the basic facts governing the action of antiseptics, together with changing concepts in the approach toward achieving sterilization of wounds, have added measurably to the complexity of the subject. The discovery of sulfonamides and antibiotics has been largely responsible for these developments and an enormous literature has accumulated on many aspects of the problem. Medical curricula, too often, are weak in presenting this subject in spite of its important bearing on surgery.

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Many antiseptics are used today solely because of tradition, a matter of habit, or because of current popularity. There is a general misconception as to what can be done to bacterial flora in the tissues by these agents. Since many compounds are used to disinfect surgical instruments or excreta and act as protoplasmic poisons, there are workers who consider all such agents in this category and therefore unsuitable for application to wounds.

In view of the many misconceptions relative to antisepsis and the plethora of statements regarding them, the author will try to present a review of the subject in a systematic manner in the following order:

1. Mode of action of antiseptics.
2. Need for antiseptics and disinfectants in surgery.
3. Those agents producing disinfection by physical means.
4. Antiseptics acting primarily by chemical activity, e. g., the "surface antiseptics."
5. Antiseptics which act by interfering with a specific function of the bacterium (sulfonamides and antibiotics).

MODE OF ACTION OF ANTISEPTICS

The terms disinfection and sterilization are often used as synonyms. The accepted meaning is that after disinfection or sterilization an object contains no living bacteria, protozoa, or fungi. Disinfection usually implies the use of chemicals to destroy micro-organisms. Most disinfectants by reason of their nature are also destructive or

harmful to tissues. Antiseptics are substances which in some cases kill bacteria and in others simply prevent their multiplication, according to the character of the product and its method of use. Thus, an ointment may be called antiseptic if it prevents the multiplication of bacteria, but a mouth wash which remains in contact with the tissues for only a short time must actually kill bacteria to be so labeled.

Few substances are germicidal in body tissues, so that the term disinfectant is reserved for agents used to destroy micro-organisms in inanimate objects or on the intact skin, while the term antiseptic is applied to those substances used to control infection in the body. The term chemotherapy was coined by Ehrlich and it is today accepted to mean the antiseptic use of a substance which inflicts maximal injury on the bacteria and minimal injury on the tissues of the body.

The ideal antibacterial agent would be one which was powerfully germicidal against all pathogenic bacteria in that bodily environment where its action was required but at the same time completely inactive against the tissues of the body. A number of other characteristics are highly desirable, as follows:

Physical properties. The substance should be in a form permitting rapid delivery and easy access to the area needed. Thus, it must be soluble in tissue fluids well beyond effective levels and it must be capable of penetrating beyond tissue exudates to the site of the offending organisms. The vehicle in which it is applied must be inert and also release the drug in effective concentrations on contact with tissues.

Stability. The substance should be stable on exposure to light, air, temperature changes, humidity, and transport.

Low Toxicity. It should lack any tendency to irritate tissue or to cause any adverse reaction on general administration.

Elimination. It should be easily removed from wounds or dressings when used locally.

Cost. The substance should be comparatively easy to prepare at low cost.

It is apparent that no single antibacterial substance so far available meets all these requirements.

For the proper selection of those agents suitable for the various needs in surgical practice it is necessary to understand the chemical, physical, and biologic properties of the substances available. Laboratory tests have been developed to screen lethal tissue poisons from those wherein low toxicity warrants further study.

A number of factors are involved in antibacterial action. The potency of an antiseptic is usually expressed as its *phenol coefficient* which is obtained by dividing the maximum inhibitory dilution of the unknown by that of phenol. Information as to the minimum concentration in which an antiseptic will act in vitro is of value in that it serves as a guide for the selection of a concentration to be used in wounds. If a concentration greater than this minimum found effective in vitro is tolerated by the tissues the antiseptic may be successful. Other factors enter the picture, e. g., dilution by tissue fluids. Thus, phenolic compounds are greatly affected by dilution in their germicidal activity, whereas the mercurials and the dyes are only gradually reduced in their activity by progressive dilution.

Time and concentration are interdependent and it is well known that if the concentration is increased less time is required for germicidal action. There is, however, a considerable variation in the speed of action between various antiseptics. The hypochlorites and peroxide are quite rapid as compared with the heavy metals and the sulfonamides, the latter being quite slow.

The temperature at which an antiseptic or disinfectant is employed is important, in that a high temperature increases the germicidal potency. This is true particularly in the case of the phenols. From the practical standpoint the use of an antiseptic at high temperatures is not feasible since the solution would either burn tissue or rapidly assume body temperature.

The susceptibility to the action of antiseptics in general varies with bacterial species. Spore formers and tubercle bacilli are quite resistant because of their impenetrability. Streptococcus fecalis, Pseudomonas aeruginosa and other gram-negative organisms possess considerable resistance to many kinds of antiseptics while gonococci and meningococci are easily killed. Many antibacterial agents show striking degrees of selective action on bacteria. For example, penicillin and gentian violet are strongly inhibitory to staphylococci but only poorly active against most gram-negative organisms. Acetic acid, in a concentration hardly affecting most organisms, readily destroys the Pseudomonas aeruginosa which is quite resistant to most substances. A knowledge of selective action is imperative in the proper choice of an antibacterial agent for use against a specific organism.

It is well established that exposure of bacteria to sublethal doses of an antibacterial agent often results in the propagation of resistant and mutant forms that become increasingly difficult to kill.

This factor has very important therapeutic implications such as the advisability of adequate dosage in the early stages of treatment and the change to another agent should habituation of the organism be suspected.

Antiseptics, almost invariably, are of greater value in vitro than in vivo, i. e., in the presence of body fluids or tissues. The organic matter with which the antiseptic comes in contact consists of plasma proteins, blood cells, and foreign bodies, such as sequestra and necrotic tissue. These, in varying degrees, interfere with the antibacterial action. It is highly important to know how a given antiseptic behaves in the presence of such material and whether any appreciable antibacterial effect remains. All known antibacterial agents are toxic in some degree to tissues as well as bacteria but the toxicity for tissue varies greatly. A number of methods have been devised for testing tissue toxicity. Thus we have a determination of minimal lethal doses by intravenous, subcutaneous, and intraperitoneal injection, and the effects after application to the conjunctiva of rabbits. These methods establish the general toxicity of an agent according to the route of administration and the effects of absorption on contact with vital tissues. Such information is most essential for drugs to be administered systemically. When the antiseptic is to be used locally the effects on the skin, muscles, connective tissue and blood cells are of primary significance. The cells of these tissues can be studied histologically in experimental wounds or by tissue culture and the action on leucocytes determined by direct study in the presence of the antiseptic. The relative vulnerability of fibroblasts in tissues is unknown and it is not established that the behavior of one type of cell can be assumed to be similar to that of another type. Howes (34) has devised a very appropriate test for the determination of wound healing following the application of an antiseptic to similar wounds. By serial photographs he establishes the effect on the rate of epithelization in terms of change in the perimeter of an island of epithelium and the effect on the growth of the surrounding granulation tissue. Only by such data is it possible to evaluate accurately the relative toxicity of antiseptics unless they produce gross and immediate toxic effects.

The choice of the mode of application of an antiseptic introduces two problems; first, how can it be applied to an area so as to exert maximum results and, second, how can the substance be maintained in the area long enough to achieve the desired results. Aqueous solutions, as a rule, provide maximum antibacterial action but in such form solutions intended for the preoperative preparation of the skin require a long time to dry. The use of alcohol as a vehicle produces more rapid evaporation and drying but otherwise it has little advantage. The case of phenol is interesting and it demonstrates the importance of the base or vehicle employed. Aqueous solutions containing 5 per cent phenol are highly toxic to tissues but the same concentration in petrolatum is bland and nonirritating to wounds. Yet because of the greater affinity of the phenol for petrolatum than for water it is released so poorly from the base that the ointment is inert (52). Generally speaking, any vehicle other than water causes some loss in antiseptic power although it may be used to secure greater solubility, reduce toxicity, or in some way to facilitate application. For immediate rapid effects, an isotonic aqueous solution is preferable, but for a more prolonged action, a number of bases is recommended; for example, a carbowax water-soluble base[1], a vanishing cream type base[2], or a lanolin type base[3]. To compensate for the slow release of antiseptics from these bases somewhat higher concentrations of the antiseptic must be included than is necessary in aqueous solution. Comparative data are needed to quantitatively express the rate of release of antiseptic from different vehicles in comparison with water (33, 36, 52).

From these considerations it will be seen that the "ideal" antibacterial agent has not been perfected. Although many compounds are antiseptic in vitro, each lacks some specific function or property that removes it from the "ideal" category. Thus, one compound may be outstanding in speed of action while another may have outstanding penetrating power. For the complete evaluation of an antiseptic a multitude of tests is necessary and the results must be carefully considered. It must be determined what concentration can be used, how this is to be maintained, and over what period of time the antiseptic must remain in the wound. Other considerations are the changes produced in the bacterial flora of the wound, the antiseptic's action on tissue repair (whether it is severely inhibited by organic matter), and the possibility of the production of drug resistance. Esthetic considerations such as staining, color, and odor, may be important (26). It is the stain produced by dyes which makes the use of these compounds unpopular.

[1]Carbowax is a trade name for a mixture of polyglycols. An excellent base may be prepared as follows: carbowax (4,000) 45 parts, propylene glycol 55 parts.

[2]A base of this type recommended by Jenkins may be made as follows: oil phase-petrolatum, 48 c.c., Arlacel C, 2 c.c.; aqueous phase-tween 80, 0.25 c.c., water q.s. to 50 c.c. Arlacel C and Tween 80 may be purchased.

[3]An excellent lanolin type base can be obtained in the market.

These many variables are difficult to control and often data on each are not available. It is consequently not always possible to establish or state definitely that one agent is superior to another. Manufacturers, by stressing some one point of superiority such as phenol coefficient or low toxicity, have introduced an enormous number of antiseptics on the market. It is apparent that some are superior to others and a clinical therapeutic test is undoubtedly the best criterion for selection, provided that one's observations are complete and on a significant number of cases. One should also keep in mind the many variables which make up any group of "like" surgical cases as pointed out by Meleney (46).

NEED FOR ANTISEPTICS AND DISINFECTANTS IN SURGERY

Every surgical procedure requires some measure of disinfection and antisepsis to convert the nonideal conditions to as near ideal as possible. Specifically, one tries to prevent the irreversible damage that is associated with the implantation of bacteria with resulting infection and to minimize the damage that ensues once infection has occurred. The surgeon should keep the following points in mind:

1. The oral cavity should receive preoperative preparation when oral sepsis is present to minimize the risk of respiratory disease after inhalation anesthesia.

2. The micro-organisms in the gastrointestinal tract should be destroyed or inhibited só that abdominal procedures will entail less risk of infection.

3. Infections of the lungs and urinary tract should be prevented or controlled when incident to or following surgery.

4. Wounds accidentally produced require prophylaxis. These are all contaminated and therefore potentially infected (3, 54). Such wounds often occur when ideal surgery is impossible because of such factors as time, geographical situation, or anatomical nature of the wound. The need for antiseptics is increased under conditions of war as adjuvants to fundamental surgical steps such as débridement, control of hemorrhage, and drainage.

5. Wounds in which bacteria have already gained a foothold and are producing an inflammatory process require appropriate treatment.

6. Methods for the destruction or inhibition of organisms which have traveled from a portal of entry by the blood or lymphatic systems to other parts of the body (generalized infection) should be instituted immediately.

7. All sutures, tubes, drains, powders, and solutions should be sterilized and all organisms contaminating knife blades, scissors, needles, and the like should be destroyed.

8. Air in operating rooms should be sterilized and cross infection eliminated in wards.

9. The micro-organisms on the hands and arms of the surgeon as well as on the skin of the patient at the site of operation should be destroyed.

10. Contamination of gloves or hands after contact with infected material such as dressings should not be overlooked and when it occurs disinfection instituted.

THOSE AGENTS PRODUCING DISINFECTION BY PHYSICAL MEANS

Dry heat or hot air. Th. Paul has shown that bacteria dried at various temperatures, according to the organism, die partly as the result of an oxidation reaction. Dessiccation is also partially responsible. Glassware and instruments which are not affected by loss of temper may be conveniently sterilized by dry heat. This is of value particularly when they should be dry in order to be stored for future use. Powders such as talcum, zinc peroxide, the sulfonamides, and others which possess a tendency to cake on contact with water, oils, and ointment bases may be sterilized by hot air at a temperature of 140° C. or over in order to destroy spores. The temperature is dependent upon the compound since too high temperatures will decompose some substances. A temperature too much above 160° C. will char cotton plugs and covers. A temperature of 140° C. for 4 hours for zinc peroxide and the carbowaxes has been found satisfactory (38). For the sulfonamides from 145° to 150° C. for 4 hours is sufficient. Six hours at 140° C. are frequently necessary for petrolatum or mineral oil which act as protectives to the bacteria.

Moist heat. Moist heat sterilizes or kills bacteria by a completely different mechanism than does dry heat. The protein of the bacteria is coagulated by moist heat which leads to quicker destruction. In the case of moist heat the thermal death points of the bacteria also vary. Spores of certain bacilli and clostridia are exceedingly resistant and may live through 110° C. and 120° C. for 10 minutes. In such cases it is necessary to heat for a longer period of time. This applies to the boiling of instruments in water or the sterilizing of linens in a steam autoclave. In an autoclave the objects being processed become water-soaked but they can be dried by producing a partial vacuum as soon as the autoclaving process is finished. Ointment bases such as the carbo-

waxes act as protectives to the bacteria against moisture. In such cases the spores are not destroyed by steam sterilization.

Ultraviolet light. Ultraviolet radiation does not effect complete sterilization but rather a reduction in the total number of bacteria present. The radiations which destroy the bacteria are found in the spectrum from 2,000 to 2,950 Angstrom units, and Finsen first treated skin tuberculosis with such ultraviolet radiation. These radiations destroy both pathogenic organisms and those causing decomposition and putrefaction (27) and they are particularly valuable in operating rooms where the effect is rapid. The incidence of operative and postoperative infection can be reduced by 50 per cent with the use of ultraviolet lamps. Cubicles for the handling of septic cases, nurseries, children's wards, and similar departments may also employ ultraviolet radiation. Unfortunately, protection against the erythema-producing effect on the eyes and skin is necessary.

ANTISEPTICS ACTING PRIMARILY BY CHEMICAL ACTIVITY (THE "SURFACE ANTISEPTICS")

Acids and Alkalies. It has been determined experimentally that the maintenance of *p*H below 5 or above 9 for a specified period of time will allow for the establishment of a state of antisepsis (1). Except in the urinary tract, the maintenance of such *p*H states is difficult, partly because of the powerful buffering and neutralizing action of the tissues and fluids. In the urinary tract it is possible to maintain certain conditions of *p*H without harm to the epithelial lining. This is accomplished by the administration of mandelates, phosphates, ammonium chloride, and similar substances. Mandelic acid is an effective urinary antiseptic.

The antiseptic activity of many acids is directly proportional to the hydrogen-ion concentration which they produce in aqueous solution. This is true also of alkalies in that their activity is directly dependent upon the number of hydroxyl ions which are produced. The theory has been advanced that acids and alkalies neutralize the free basic or acidic portions of protein and consequently destroy the bacterial organisms. Some acids exert their bactericidal effects because of the undissociated molecules. Among these are included acetic, lactic, benzoic, salicylic, and mandelic acids.

The strong mineral acids which dissociate readily are not practical because of the fact that they irritate the skin and mucous membranes and are too caustic. Boric acid has been employed for years as a relatively nonirritating although weak germicide for the eyes and for burns. It is a cumulative poison when applied to extensive raw surfaces and, since its antiseptic action is doubtful, other agents would be more efficient (50). Superficial dog bites are sometimes cauterized with nitric acid although some believe it valueless since the rabies virus spreads so rapidly.

The organic acids are much less dissociated and therefore less powerful than the inorganic or mineral acids. Superficial Pseudomonas aeruginosa infections are destroyed with weak solutions of acetic, lactic, or propionic acids, preferably in buffered solutions. These acids are also fungicidal. Buffered solutions of these acids are preferable in order to prolong the time of activity as well as their effectiveness. Experiments in vitro have shown that a weak solution of acetic acid requires from 10 to 15 minutes to destroy cultures of the Pseudomonas aeruginosa. Thus, it is clear that a vehicle is necessary to maintain the agent in longer contact and to inhibit neutralization by tissue fluids. A carbowax base containing 3 per cent acetic acid and 4 per cent sodium acetate is less irritating and possesses a more prolonged action than a 3 per cent solution of the acid alone (53).

It has been stated previously that maintenance of a high degree of alkalinity (above a *p*H of 9) is not conducive to the life of bacteria. Alkalies possess a solvent action in dissolving proteins and saponifying fats, which property is of value in wounds if the agent is continuously applied. The Carrel-Dakin hypochlorite treatment is typical of this technique (9). Caution must be observed in such technique since too great an alkalinity is irritating and corrosive to the skin and other tissues (48). Repeated application of mild acids has been found less harmful in animal wounds than that of mild alkalies (35).

Alcohols. Absolute and 95 per cent strengths of ethyl alcohol are relatively ineffective. The greatest bactericidal power is obtained with a concentration of 70 per cent by weight. The activity is diminished considerably if this is varied (48). In 70 per cent strength only the less resistant bacteria are killed. The property of coagulating proteins which ethyl alcohol possesses, in turn, makes it locally toxic to tissues. Consequently, bacteria may be protected from its effect. Chloroform and ether will do the same. This coagulation of protein probably is the cause for the decrease in efficiency of other antiseptics when alcohol is employed as the solvent (24). Thus, alcohol is not to be recommended in cleansing wounds of bacteria, dirt, and greases. Experimental work has revealed that spores survive indefinitely in the presence of ethyl alcohol (38). Alcohol is commonly used to sterilize rubber caps of vials but when sporebearing dust has accumulated such an

agent is unreliable. Brief immersion of instruments in alcohol or wiping with an alcohol sponge does not guarantee sterility.

Ethyl alcohol is definitely of value in reducing bacterial flora after scrubbing. Hatfield and Lockwood state "Through a modification of the Price technique, by which the effectiveness of antiseptics *on freshly scrubbed* skin is evaluated, it is concluded that alcohol in strengths of 95 per cent and 70 per cent by weight is preferable to any group of commercially prepared agents specifically designed for skin sterilization."

Isopropyl alcohol, a wartime replacement for ethyl alcohol, is more bactericidal against the vegetative forms than is ethyl alcohol and the isopropyl is used in full strength (about 99 per cent), at which concentration it is most effective (48). The cleansing properties of isopropyl alcohol are better, due to its lower surface tension. Since isopropyl alcohol is used in full strength it is less corrosive for surgical instruments because of the lower water content. Just as in the case of ethyl alcohol, isopropyl alcohol cannot be depended upon to kill spores. Routine use of alcohol is made for the prevention of bedsores and decubitus ulcers, to harden the skin, and minimize sweating in bedridden patients.

Aldehydes. The one aldehyde with significant bactericidal activity is formaldehyde. It is a gas, readily soluble in water and thus employed in aqueous solutions. Formaldehyde possesses an advantage over alcohol in that in proper concentration it is effective against spores as well as all forms of organisms. Its value lies in the sterilization of surgical instruments, gloves, and excreta, but its irritant and coagulant properties preclude its use on the body. A solution with a less objectionable odor than formaldehyde and one which does not corrode surgical instruments has been developed for cold sterilization of instruments by Tainter as follows: isopropyl alcohol 1,000 c.c., oil of rose geranium 2 c.c., oil of cinnamon (or cassia) 4 c.c., distilled water 780 c.c., sodium nitrite 4 gm., triethanolamine 60 c.c., and solution of formaldehyde U.S.P. 160 c.c. This solution has been shown to destroy spores and is most reliable. Methenamine, forming aldehyde, is effective mainly in the urine since its action is to slowly release formaldehyde in acid solution. It is inert at the neutral or slightly alkaline *p*H of wound exudates.

Anionic and cationic types of antiseptics (1, 2).

The anionic antiseptics are the neutral or faintly alkaline sodium or other salts of acids of high molecular weight. The most familiar example of this type is common soap. The ammonium and calcium mandelates and the "acid dyes" such as acid fuchsin are also included. An enzyme system in the bacteria is interrupted by an interaction between the acidic ions of the agent and certain basic ions in the bacteria. A *p*H value more acid than blood is necessary for the reaction as confirmed by reports from the literature, showing that anionic antiseptics have not been effective in wound exudates and only moderately effective as skin antiseptics. The use of mandelates in acidified urine is the only reliable application of anionics. Soap is commonly employed in surgery in the form of a lather, as a cleanser. Used in this manner it removes water-insoluble liquids by emulsification and solid particles of dirt and bacteria by suspension. Removal of particles is also aided mechanically by rubbing or brushing. Soap action varies with the fat from which it is made. The staphylococcus and colon bacillus are least affected by soaps, but soaps have some germicidal powers against the *Streptococcus pyogenes*, the pneumococcus, the gonococcus, and *Treponema pallidum*. Soaps should not be relied upon to produce skin sterility. After mechanical cleansing it is necessary to eliminate the transient and resident bacteria. Mercuric iodide enhances the bactericidal property but certain disadvantages restrict its use. A promising new compound when incorporated with soap for the preparation of the skin in surgery is a synthetic phenol known as "G-11." Chemically, "G-11" is 2,2′-dihydroxy-3,5,6-3′,5′,6′-hexachloro-diphenyl-methane. Regular daily use of this compound in soap considerably reduces and maintains low bacterial counts (63).

Cationic antiseptics act conversely to the anionic group by combining with certain essential acidic groups in bacteria to form nonionized complexes. These essential ions which are probably nucleic acids are thus immobilized. Since the nucleic acids comprise 20 per cent of the dry weight of streptococci it is clearly shown how important this immobilization is. Included in this group are a large number of compounds which have one common characteristic, namely: they are salts of bases of high molecular weight and usually are hydrochlorides or sulfates. Included in this large class are the "basic dyes," such as brilliant green and crystal violet; the acridines, such as proflavine and 5-aminoacridine; and the quaternary ammonium salts exemplified by "zephiran," "phemerol" and "ceepryn." Most of these compounds form neutral aqueous solutions. Several are colorless whereas others are highly colored since they are dyes.

The dyes and organic bases. There are 5 classes under this heading. (1) The azo dyes, of which scarlet red is the best known. Scarlet red is

claimed to stimulate the proliferation of epithelial cells rather than act as an antiseptic. Its clinical value is a subject of controversy. Five per cent of scarlet red alone or with 0.5 per cent oxyquinolin sulfate in ointment form is employed to stimulate wound healing in burns, superficial wounds, and chronic ulcers. (2) The acridines include acriflavine hydrochloride ("acriflavine"), proflavine hydrochloride, "rivanol," and 5-aminoacridine, which is nearly colorless. The acridines possess an advantage in that their action is not seriously inhibited by serum. In strong concentrations they are bactericidal and in high dilutions bacteriostatic. The acridines are highly active against gram-positive organisms and moderately so against gram-negative organisms. Of this group, proflavine and 5-aminoacridine are preferable since they are the least toxic to tissues. Their range of biological activity is similar. Proflavine is a yellow dye which requires a *p*H adjustment before use because of its acidity in solution. 5-Aminoacridine, being nearly colorless, does not stain the skin nor the clothing and it is available as the neutral hydrochloride. These drugs possess an advantage over the sulfonamide drugs in that they are not inactivated by p-aminobenzoic acid nor are they inhibited by pus except for a mechanical interference. The British employ these useful antiseptics extensively in wounds and for preoperative skin preparation [Bonney's paste (5)], since they are more active than the sulfonamides against the *Clostridium welchii*. A 1:100 proflavine-sulfathiazole powder spray is highly recommended for treating contaminated and suppurating battle wounds (45). Further trials should be carried out with these drugs. Solutions of the colored acridines must be stored in amber bottles due to their instability in light. (3) The fluorescein dyes include fluorescein alone and in combination with mercury, for example, mercurochrome. Fluorescein stain possesses no antiseptic powers. It is employed as a diagnostic agent in the eye to determine corneal damage, and intravenously with a Wood filter to diagnose the degree of burns; third degree burns appear black and second degree burns take on a yellow-green hue (14). Mercurochrome (24) is a comparatively weak disinfectant in neutral or alkaline medium. It has been much publicized as an all-purpose antiseptic. Early experiments gave startling results because of its use in acid media but further work has shown it to be weak in neutral or alkaline solution. Numerous experiments have shown that it can be condemned on the basis of insufficient antibacterial power since it is incapable of sterilizing skin, superficial wounds, or infected blood. (4) The basic dyes, which include crystal or gentian violet (6, 11, 48, 61) and brilliant green, are widely used as surface antiseptics for which purposes they have been recommended. Both are bacteriostatic but not strongly bactericidal. They are selective in that they act particularly against gram-positive organisms and are practically ineffective against gram-negative bacteria. Species within species resistance is not uncommon. When employed in wounds the basic dyes coagulate proteins which forms an eschar under which the bacteria grow freely since the effect of the dyes is superficial. Infected wounds such as chronic ulcers, and mucous membranes and serous surfaces have been treated with these dyes. Because the dye coating of burns delays skin grafting, masks cellulitis and erythema, and is expensive from the standpoint of soilage of linens and laundry cost, it has been largely abandoned. (5) Methylene blue is feebly antiseptic. Its use now is limited chiefly to enhance visualization in fistulous tracts such as the pilonidal and anal.

Quaternary ammonium compounds (2, 7, 31, 58). Domagk, in 1935, shortly after introducing prontosil, reported on the preparations known as the quaternary ammonium compounds. The first to be used in the United States was "zephiran," which was followed by "phemerol," "ceepryn," and others. They are cationics and also are surface tension depressants. This latter property causes water to foam when a small quantity of the agent is added and shaken with it. A wide variety of organisms falls prey to these agents which are rapidly bactericidal. Pus cells, tissue debris, blood, and similar materials reduce their antibacterial activity. Areas which are first cleansed with soap must be carefully rinsed before use of these agents. Soaps, being anionic, i. e., bearing a negative charge, react with them and neutralize their effect.

The quaternary ammonium compounds are most advantageous in the preoperative preparation of the skin of both the surgeon and the patient (7, 31, 58). The tissue surfaces are well wet and penetrated by such agents due to their low surface tension, and their detergent[1], keratolytic,

[1]Detergency is a phenomenon dependent in part upon the lowering of surface tension which likewise produces foaming. A large number of surface active substances have been introduced in recent years varying widely in their chemical composition. Such substances characteristically possess a hydrophilic (polar) group or groups which likewise solubilize the compound, and a lipophilic (nonpolar) group. With part of the molecule having affinity for water and part being attracted by oil or air, the molecule is capable of orienting itself at an interface whereby interfacial, i.e., surface, tension is reduced.

Surface active agents are classified as anionic which carry negative charge, cationic which are positive, and nonionic which are unchanged. Soap and sodium lauryl sulfate are examples of anionic agents and the quaternary ammonium salts are the best examples of cationic agents.

Detergents by dispersing oils and adhering dirt from the skin greatly facilitate its cleansing and also assist in the cleansing of burned areas and in removing dressings. Most detergents are relatively nonirritating and some (the quaternary ammonium salts) are decidedly antibacterial in their action.

and emulsifying action. In antibacterial activity they are comparable to tincture of iodine. The concentrations necessary for an antibacterial effect are relatively nonirritating. In one respect the surface activity of the cationics is a disadvantage. In repeated applications to wounds they disrupt tissue elements, and cause hemolysis, and their antiseptic strength is diminished by the protein present. The cationic detergents also are not very effective against spores (48). Surgical instruments may be sterilized and these detergents used for storage of sterilized instruments, provided their ineffectiveness against spores is kept in mind. Corrosion is prevented by the addition of 0.5 per cent of sodium nitrite.

Halogens. No two chemicals possess as well known a reputation for active germicidal action as do chlorine and iodine. Their reaction to form combinations with the protein amine groups is responsible for their antibacterial activity. Continual application or constant renewal of applications is necessary since proteins rapidly inactivate them. The hypochlorite solution commonly known as Dakin's solution is usually employed in place of chlorine. As previously mentioned, the alkalinity of the hypochlorite solutions is an additional advantage. As a result of the alkalinity they possess a destructive and solvent action on bacteria, pus, necrotic tissue, silk, and catgut. The well known Carrel-Dakin technique (9) of irrigation meets the necessary prerequisites of constant renewal. The disadvantages of this treatment are several:

1. Irrigations must be constantly renewed, special apparatus is necessary, and the daily change of dressings, even if painlessly accomplished, predisposes to recontamination of the wound from outside sources.

2. The surrounding skin must be protected (by petrolatum gauze), or bothersome irritations will occur.

3. An alkalinity of *p*H 10 must be maintained by buffers, because tissue irritation is marked on either side of this range. Thus, the solution must be made daily and kept in dark bottles, because of its photolability. (The U.S.P. preparation is a buffered solution).

The next compounds to be considered, namely, chloramine-T, dichloramine T and azochloramid, act more slowly and combine with organic matter less rapidly but their activity is more prolonged, particularly when serum proteins are present. Unfortunately, they do not possess the effect on slough that Dakin's solution does (24). They are more stable but are photolabile and must be stored in amber bottles. The problem of azochloramid in relation to wound healing was studied carefully by Anderson. Single applications for several days caused a reduction of the bacterial flora in granulating wounds but not in sloughing wounds. Healing time was not influenced in either type. In in vitro studies, azochloramid possesses a synergistic action with the sulfonamides but no proof has been advanced of this synergism in the body.

Iodine has had a wide reputation as an efficient germicide. It is commonly used in the form of the tincture and is one of the most reliable agents for preoperative skin preparation. The chief advantage of the tincture is the rapid drying brought about by evaporation of the alcohol. Although the tincture has been so widely used the aqueous solutions of iodine are gaining in prominence as more and more reports appear on their highly germicidal action. Lugol's solution, U.S.P., in a 1:6.4 dilution has been shown by Nye (49) to be active in vitro. For preoperative skin preparation the aqueous solutions possess certain advantages. Kraissl and Meleney compared certain aqueous preparations (ethiomine, tetrodine) with tincture of iodine, U.S.P., on guinea pigs. The addition of certain surface active agents to these aqueous preparations causes them to spread, penetrate, and dry more quickly than Lugol's solution. Where the tissues are abraded there is no stinging sensation as with the alcoholic preparations. The use of aqueous iodine preparations has been slow as a result of a necessity to choose between proprietary preparations.

There are available certain organic iodine compounds (chiniofon, vioform, diiodoquine) which possess no antiseptic value in their use as dusting powders on wound surfaces. Extremely low solubility is the responsible factor. Their use is limited mainly to that of amebicides (26, 48). The penetrating odor of iodoform has long been associated with antisepsis. However, its solubility in water or serum is so slight that it is practically inert. No confirmation has been presented that iodine is liberated by iodoform in contact with tissues. Thymol iodide (aristol) possesses no value as a local antiseptic for its solubility in water is still less.

Heavy metal salts and compounds.

Mercury. Cells contain sulfhydryl (SH) groups which are coagulated by inorganic mercury salts to form mercury proteinates. Functional enzyme systems are inactivated and deprived of nutritional support by the compound formed. The reaction is reversible and under optimum conditions the proteinate is dissolved and the bacteria are free to resume normal activities. The bacterio-

static action of the mercurials therefore is diminished considerably by the presence of skin, blood, and wound exudates which contain sulfides and sulfhydryl groups. In addition, the simple mercuric compounds are irritating and toxic and not safe for use in wounds. Mercuric chloride solutions which are acid in reaction are very slow in their antibacterial action. This coupled to the fact that a small quantity of soap inactivates a whole basin of the solution is a drawback to their use as hand rinses. Sterilization of instruments with these compounds is precluded because of their corrosive action. In the disinfection and storage of mechanically clean catheters, bougies, filiforms, and similar instruments, when there is no danger of spore contamination, a 1:1,000 solution of mercury oxycyanide is used. The germicidal activity of soaps has been increased by the incorporation of alkaline potassium mercuric iodide. The flora of the skin is not appreciably reduced by this compound or mercuric chloride, but strangely a "sterile" cutaneous surface may be produced. Price explains this as being due to the transparent film on the skin under which the bacteria are confined. Multiplication occurs under this film. The bacterial flora present doubles every 50 minutes. Sweating breaks the film and the uninjured bacteria are released.

Merthiolate, a complex organic mercurial, and metaphen, a phenyl mercuric compound, and related agents do not take a very clear position. They do not liberate readily inorganic mercuric ions, but they possess cations of high molecular weight which opens the possibility of their behavior as cationic antiseptics. Compared with the simple mercury compounds, their potency is much greater, and their toxicity and irritating power are considerably less. In the presence of serum proteins they retain a fair proportion of their activity but blood and pus inhibit their activity to some extent. They are not suitable for wounds and are not as efficient as is commonly believed for the disinfection of instruments (6). As preoperative skin disinfectants they are widely used. Their slow action (slower than iodine) and their lack of sporicidal action are disadvantages. Johnson (37) has found that merthiolate is unreliable as a preservative for stored liquid plasma.

Silver and silver foil. Metallic silver is bactericidal and is economically practical in the sterilization of water. Very little evidence has been accumulated in favor of the insertion of silver foil into wounds as an application of the principle of oligodynamic action of metals. A compound of silver, namely, the nitrate, is employed in surgery mainly for cauterization. It is also of use in trimming of granulation tissue and warts. Corrosion, astringency, pain, and irritation accompany its application. Silver nitrate formerly was used with tannic acid in the treatment of burns. This has been discontinued because it increases the depth of the burn, masks cellulitis and infection, and delays wound healing and early skin grafting. Colloidal silver compounds provide antisepsis by the release of very low concentrations of silver ions. In addition, they are noncorrosive and relatively nonirritant. These compounds are employed mainly on mucous membranes. Argyria, an irremediable discoloration of the skin or mucous membrane, may occur as a result of the use of silver for a long period of time. Solutions of silver should be freshly prepared as they are photolabile.

Bismuth. Mechanical protection of inflamed or irritated surfaces is provided by the insoluble bismuth compounds. Antiseptic action is possessed by certain combinations of phenols and bismuth salts in which the hydrogen in the benzene ring has been replaced by bromine or iodine, such as bismuth tribromphenate (xeroform). This compound is recommended by plastic surgeons to cover areas of skin grafts and donor sites (66). No delay in wound healing has been observed under this dressing. Xeroform is applied in ointment form, for which the formula is: bismuth tribromphenate 3, petrolatum 95, paraffin 1, beeswax 1. Several layers of narrow mesh gauze in a rectangular tin box are impregnated with the ointment and the whole sterilized in the oven at 140° C. for 4 hours.

Oxidizing agents. The oxidizing agents act against bacteria by oxidation of the protoplasmic constituents. Included in this group are ozone, the permanganates, and peroxides. Agents of this type are particularly effective against anaerobic organisms which are inhibited by a high concentration of oxygen. Proteins inactivate these oxidants and no distinction is made between those of bacteria and of tissues. They must be constantly renewed in order to sterilize unless the effect is instantaneous. Zinc peroxide (U.S.P., medicinal grade), recently introduced, is the only peroxide which has prolonged action.

The powder may be employed as a 40 per cent cream made with sterile water or a 20 per cent ointment made with a carbowax base (55). Both must be freshly prepared. In these vehicles the zinc peroxide will slowly liberate oxygen in a wound for 24 hours. In vitro tests have shown this chemical to be bactericidal to sporulating anaerobic gram-positive bacilli, hemolytic streptococci and pneumococci, anaerobic cocci

and bacilli, but not to the staphylococcus or most aerobic gram-negative rods. Many uses have been developed for zinc peroxide in surgery, among which are included the following: (1) orally, as a mouth rinse and gargle, in Vincent's angina and pyorrhea alveolaris; (2) topically, on foul smelling, indolent wounds such as ulcerated cervical cancers which are covered by sloughs and produced by gram-negative anaerobic nonspore-forming bacilli such as the *Bacillus fusiformis* and the *Bacillus necrophorus*; (3) in conjunction with excision and wide exposure for control of the chronic indolent burrowing ulcers caused by a microaerophilic hemolytic streptococcus (48); (4) in conjunction with excision of devitalized tissues and wide exposure for control of the spread of bacterial synergistic skin gangrene caused by the symbiosis of two or more organisms (48); (5) in empyema after evacuation and rib resection when anaerobic mouth organisms are located on the remaining fibrin and adherent slough; (6) around colostomies as a dressing, in the perineum after prostatectomies and resections, and in the anal canal after hemorrhoidectomies and fistulectomies (8). Zinc peroxide does not reach the deep and widespread infiltration of the infection; therefore it does not have a material influence on gas gangrene unless the exposure is adequate. Zinc peroxide decomposes into zinc oxide and hydroxide which remain in the wound and provide a disadvantage. In rectal cases their astringency is advantageous. The vehicles in which zinc peroxide is suspended are absorbed or washed away by exudates which causes the chemical to dry. Therefore, the wounds should be protected by layers of water-saturated cotton and several thicknesses of petrolatum or zinc oxide ointment gauze. Although hydrogen peroxide is a weak antiseptic it does have some value in surgery as an aid in releasing sticky exudate-soaked dressings, cleansing surface wounds and like conditions. A mixture of hydrogen peroxide with tincture of green soap is useful in removing crusts and dried wound exudates. The concentrations necessary for potassium permanganate to be effective are irritating and therefore it is no longer recommended.

Phenols and phenolic derivatives. Phenol is the simplest of this group of antiseptics. It is soluble to the extent of approximately 6 per cent in water. Because of its great destructiveness to tissues, its use in surgery is limited chiefly to opening furuncles by allowing the phenol on a needle or toothpick to puncture the center of the furuncle and simultaneously seal off the capillaries (bloodless technique). Although more bactericidal and less toxic, the higher phenolic derivatives are less soluble in water. The cresols, of which lysol (a mixture of ortho-, meta- and paracresol) is best known, must be dissolved by means of soap in order to be effective. Lysol is three times more bactericidal than phenol and slightly less toxic, but its caustic property renders it unfit for wound or skin applications. Lysol is chiefly used for the disinfection of contaminated utensils and the scrubbing of walls, floors, and bath tubs. Cresols, unfortunately, are not sporicidal and not very soluble in water; they possess a strong and persistent odor, and lose germicidal activity when mixed with too much soap. Hexylresorcinol, rejected by the Council of Pharmacy and Chemistry in 1936 as an antiseptic for the N. N. R. but official in the U. S. P. as an anthelmintic, is highly bactericidal under optimal conditions. It is irritating to tissue and its activity is diminished by organic matter. Thymol is fungicidal and has produced varying results in the treatment of actinomycosis, blastomycosis, moniliasis, and coccidiodal granuloma. Trinitrophenol, commonly known as picric acid, is not so widely used as a burn dressing and for preoperative preparation of the skin as formerly because of the fact that it is a systemic poison and occasionally causes a severe local dermatitis. A valuable disinfectant with low toxicity for use on inanimate objects is a combination of certain synthetic alkyl and halogen phenolic derivatives known as amphyl. Moderate amounts of organic matter do not inactivate it. Pulaski and Meleney (53) found parachlorophenol to be most effective against Pseudomonas aeruginosa and Proteus vulgaris in dilutions of from 1:3,000 to 1:5,000 both in vitro and also in the control of superficial and adequately exposed wounds infected with these organisms. A concentration of 0.25 per cent in carbowax base applied once daily is recommended.

COMMENT

The many antiseptics that have been presented represent the continued efforts throughout the years to improve surgical antisepsis. Their acknowledged failure as "all-purpose antiseptics" has resulted in widespread pessimism concerning their utility in practice. Two quite opposite trends have developed: first, there are new antiseptics constantly being introduced and used; second, a trend has developed which might be termed "antiseptic nihilism;" it discredits all antiseptics for use in wounds and recommends the use of agents to stimulate the normal mechanisms of the body in combating the infective process. According to this school of thought only heat and

salt solutions (lymphagogues) should be used, such as sodium chloride, sodium sulfate, and magnesium sulfate.

Is it not too much to ask that all the requirements of the "all purpose antiseptic" be met by a single substance? It is certain that up to the present no chemical has been discovered which effectively combines all of the properties demanded of a general antiseptic, although a considerable amount of time has been spent in search of it; at present the all purpose antiseptic appears to be an impossibility.

For many years clinicians and investigators have had a fixed idea concerning a "general purpose antiseptic" and this idea has been perpetuated by pharmaceutical houses in their advertising. The term itself suggests that there are substances effectively antibacterial against all forms but still sparing the body tissues. Such generalities should be succeeded by the choice of specific substances which perform the best for a specific requirement, which is in essence the concept of chemotherapy. By such means one selects agents having a much greater affinity for the bacteria present than for the tissues of the host so that the micro-organisms can be overwhelmed at minimal expense to the surrounding tissues. It has been pointed out how certain agents can be used with maximum advantage against certain organisms, i.e., they are chemotherapeutic, while others are so damaging to tissue that they can only be used on nonliving matter.

The "physiological school" also falls into similar errors as those who believe in an "all purpose antiseptic" by limiting therapy to heat and saline solutions, whether passive (isotonic) or active (hypertonic). Although the use of hypertonic salt solutions can hardly be called physiological, both methods commit the same error in disregarding the bacterial flora of the wounds. In their place these methods, like a given antiseptic, have value but not universally so.

ANTISEPTICS WHICH ACT BY INTERFERING WITH A SPECIFIC FUNCTION OF THE BACTERIUM (SULFONAMIDES AND ANTIBIOTICS)

In previous sections those agents which act as antiseptics when locally applied have been discussed. In this section will be discussed those agents which control infection by what might be called systemic chemotherapy. There are many more possibilities for the use of agents of this type than for the others. Chemotherapy by means of the circulation began centuries ago with the treatment of syphilis by mercurial inunction. It has progressed through the ages to the sulfonamides and antibiotics for treatment of bacterial infections.

Ehrlich and Shiga in 1904 used trypan-red, a synthetic dyestuff, to cure an acutely fatal general infection in mice due to trypanosomes. Quinine was the only substance ever used before in an analogous manner. Behring's successful use of antitoxin in diphtheria was valuable but serotherapy still did not furnish a universal method of treating bacterial diseases. This coupled with the fact that a synthetic organic compound had cured a protozoan infection furnished the incentive for research. Examination was made of the aniline dyes. Gentian or crystal violet was shown by Churchman to have powerful antibacterial action. Morganroth and his associates reported that optochin (an alkaloid of the quinine group) had cured mice whose blood was infected with virulent pneumococci. In the untreated controls a rapidly fatal septicemia occurred. No similar effects had been achieved with any other drugs or organisms in other animals. Antisera, antitoxins, and bacteriophages were introduced but the situation was still not very hopeful.

A. Sulfonamides (60). Domagk in 1935 announced that hemolytic streptococcal sepsis in human beings as well as in mice could be controlled by treatment with certain azo dyes. No announcement of any chemotherapeutic agent was ever so startling or so immediately effective in saving many lives. Sulfanilamide was discovered to be the active part of the dye molecule. The new age of chemotherapy which this discovery heralded has led to more fundamental progress in antisepsis as well as to the solution of many problems of therapy. The search for new agents has become more rationalized. The sulfonamides act systemically by confining their action to a specific function of the bacterium rather than by exerting a universal chemical effect such as that employed by the antiseptics discussed in previous sections.

As a result of certain inherent characteristics information on the sulfonamides was rapidly accumulated. Inexpensive manufacture and general use resulted from their comparative chemical simplicity and feasibility of synthesis. This latter factor showed the way for the preparation of many derivatives of the original compound. In vitro study is possible since the sulfonamides do not require the natural defenses of the body for their effect. Not only do they dissociate as acids but the presence of an amino group which can be rapidly diazotized allows for accurate and fairly simple colorimetric tests of concentration in the body fluids. Thus, the calculation of therapeutic

levels is expedited. The mode of action of the sulfonamides is much less definite than are their therapeutic properties and their limitations due to toxicity and ineffectiveness against certain types of organisms. The discovery (67) that p-aminobenzoic acid neutralized the effect of sulfonamides on hemolytic streptococci in vitro and in vivo led to the conclusion that these drugs must displace or block the utilization of an essential metabolite, probably p-aminobenzoic acid, from a bacterial enzyme. With this enzyme system no longer able to function, the organisms could not utilize food material and were unable to survive. Thus, the fact that the sulfonamides attack a specific function of bacteria was established. This was one of the first successful attempts in the establishment of antisepsis by this method and proved of great biological interest (13).

Phagocytosis has always been an important factor in eliminating infectious organisms from the body. The sulfonamides allow the host to act against the organisms, which is a *secondary* factor in their activity.

Unfortunately, there are substances of importance to the surgeon which also inhibit sulfonamides. Procaine and other related local anesthetics are esters of p-aminobenzoic acid. When injected they decompose into the parent compound. Inhibiting substances are also present in peptones, pus, and necrotic tissue.

Bacteriological diagnosis, proved efficacy, pharmacological properties, and toxic reactions (variety, frequency, and severity) are the factors to be considered by the surgeon in choosing a sulfonamide compound for control of surgical infections. Sulfadiazine is the best drug for infections caused by the hemolytic streptococcus, pneumococcus, meningococcus, Friedlander's bacillus, and also for Bacillus coli and other sulfonamide sensitive urinary tract infections. In gonococcic infections, sulfathiazole is preferable. Sulfasuxidine takes precedence in bacillary dysentery and in preoperative reduction of the gram-negative flora of the intestine. Hemolytic Staphylococcus aureus, the enterococcus, and the viridans group of streptococci are comparatively unaffected by sulfanilamide and sulfapyridine. Sulfonamide therapy is ineffective against anaerobic and microaerophilic hemolytic streptococcus infections irrespective of location. Gas gangrene is not prevented nor is its course influenced by the sulfonamides. They are of little value in brucella, pasteurella, and hemophilus (influenzae) infections.

The local treatment of some bacterial infections by means of crystalline sulfonamides has attained widespread use following the report of control of infection in compound fractures by Jensen, Johnsrud, and Johnson. Colebrook found sulfanilamide valuable when applied topically to superficial open hemolytic streptococcal infections. As a result of lay publicity on the control of infections in war wounds, the sulfonamides are enjoying popularity as general purpose antiseptics. The local use of sulfonamides has been carefully reinvestigated. When used to greater extent than a dusting of soluble sulfanilamide they may cause irritation, produce exudate, delay healing and promote the formation of adhesions. Inhibition by necrotic tissue and pus is pronounced. Rapid absorption and toxic blood levels result from the application of more than 10 gm. over extensively wounded or burned areas in a 24 hour period. When continuously applied to intact skin for more than 5 days sensitization may occur. This is exceedingly dangerous since it may prevent the use of the sulfonamides later in an infection against which no other drug is effective. The factors are serving to reduce the local use of sulfonamides for wound antisepsis. It is now felt that local use of sulfonamides in wounds has no advantage over systemic administration of the drugs.

DRUG RESISTANT INFECTIONS

There has been observed in a certain proportion of cases of pneumonia, wounds, burns, meningitis, and gonorrhea, that the sulfonamides do not control the infection. Worthy of particular mention are those refractory cases which obviously have the same species of causal organism and clinical features as the responsive ones. Such organisms are believed to be drug-resistant. The infection first is affected by the drug but before it can be controlled the organisms develop resistance. The resistant bacteria in turn propagate resistant bacteria. They still retain their virulence. Variance in defense by the host also plays a part but this cannot be measured readily. In vitro testing of the responses of each patient's strain of organisms to sulfonamides has been developed into a simple technique (25). With this test accurate prognosis of the results can be made and the period of time wasted before recognition that other forms of therapy are necessary is decreased. This in vitro testing promises much for the future, for in some infections (fulminating) life is dependent upon the early use of the proper drug.

B. Substances of Biologic Origin.

Nature is a treasure of antibacterial agents. Quinine, emetine, chaulmoogra oil, tannic acid, and many others are plant products. Even cabbage, onion, barberry plants, and others have

provided extracts which possess bacteriostatic agents. Chlorophyll has been found of promise in the acceleration of wound healing (59). Many of these substances require further investigation. Selective antibacterial properties are found in substances contained in tissues and body fluids.

Toxins, antitoxins, and immune sera come from animals. The prophylaxis of gas gangrene with such products is not as clear-cut as immunization in diphtheria and tetanus. The specific antibody still retains an important position in the prophylaxis and treatment of bacterial infections. In infections of the gas gangrene and Clostridia tetani group, bacteria are so actively toxigenic that penicillin and the sulfonamides have very little direct neutralizing effect upon the toxin.

1. Antibiotics. Bacteria and fungi recently have attained great prominence as sources of chemotherapeutic agents. Seven groups of microbial products produced from an amazingly large variety of unrelated micro-organisms have been listed by Waksman (64). Included in this listing are polypeptides such as tyrothricin, pigments such as pyocyanin (alphaoxyphenazine), lipoids, such as pyocyanase, organic bases such as streptothricin, simple organic molecules such as hydrogen peroxide, and others, such as penicillin. In general, the antibiotics are toxic to animal tissues just as are the synthetic chemical compounds. Many antibiotics have been isolated but only the following 4 show therapeutic promise: tyrothricin, penicillin, streptothricin, and streptomycin. The N.N.R. has approved the first 2. The use of pyocyanase in the local treatment of infections has been discontinued or limited due to its instability, variability of organisms from which it was derived, and lack of information on the conditions controlling its formation.

a. Tyrothricin. Dubos (17) in 1931 first extracted tyrothricin from cultures of Bacillus brevis, a gram-positive, aerobic, sporeforming, soil organism. To this worker should go the credit for renewing the interest in antibiotics. Tyrothricin is a protein (polypeptide) and a hemolytic agent which makes it dangerous if given intravenously. It is ineffective intravenously and orally as well. It consists of at least two substances, gramicidin and tyrocidin. Gramicidin is more active and, although hemolytic, is relatively nontoxic for other tissue cells. Several species of gram-positive organisms such as pneumococci, streptococci, and staphylococci are susceptible to its action. It is of value in mastoiditis, burns, empyema, superficial ulcers, and similar conditions in which direct contact locally can be accomplished. Its limited penetrating powers restrict its use in deep seated infections. Tyrothricin inhibits enzymatic action in the bacteria, causing a retardation of growth and lysis of the cells. Saliva, urine, and serum do not inhibit it to any degree. It is greatly inhibited by gram-negative bacilli which in mixed infections may even protect the sensitive gram-positive bacteria.

b. Penicillin. Penicillin is a solid substance extracted from broth cultures of the mold, Penicillium notatum. The sodium and calcium salts are the forms principally used. Fleming discovered the presence of penicillin in 1929, but it was not applied clinically until Chain and others produced it in sufficient quantity.

Penicillin is a yellowish brown powder and is marketed in sealed ampules. It is unstable in air, hygroscopic, and loses potency rapidly when exposed to heat, alkalies, acids, primary alcohols, and oxidizing agents such as hydrogen peroxide. Crystalline sodium penicillin, just recently released, is much more stable and can be stored at ordinary temperatures without refrigeration. It is believed that some of the impurities which cause reactions in some patients have been eliminated in this product. Penicillin is extremely soluble in water, and saline and dextrose solutions. The potency of penicillin preparations is measured by comparing them with a standard using either the serial dilution method or a modified agar cup technique and a standard strain of organisms.

In penicillin therapy it is necessary to know the infecting organism. Gram-positive cocci and bacilli, spirochetes, gonococci, and meningococci are very susceptible, but gram-negative bacilli and acid-fast bacilli are resistant. Enzymes (penicillinases) produced by gram-negative bacilli and by certain aerobic, gram-positive, sporebearing bacilli such as the Bacillus subtilis group inactivate penicillin. It is also rapidly inactivated by certain strains of resistant micrococci. Infections due to pure cultures of susceptible organisms are considerably more affected by penicillin than are those due to mixtures of gram-negative and gram-positive organisms. Penicillin is the least toxic of all known antibacterial substances. Reference was made to resistant strains and acquired resistance under the sulfonamide drugs. These factors are also prevalent in penicillin therapy, but to a lesser degree.

Penicillin possesses certain advantages over the sulfonamides. It is less toxic and therefore there is no tendency to cause the side effects observed with the sulfonamides. Large numbers of bacteria, blood, pus, peptones, or necrotic tissue products do not inhibit it when applied locally.

In local administration it tends to diminish the exudate rather than increase it. Drug-fastness or resistance is less frequently observed. Unfortunately, it possesses specificity of action, is inhibited by gram-negative bacilli, and is rapidly absorbed and excreted, which makes frequent dosage necessary. Instability was initially a disadvantage but this has been diminished to a considerable extent.

Oral administration of penicillin in conjunction with alkalies and other compounds has been accomplished and provides a simpler method of maintaining bacteriostatic levels (18). By the oral route several times the parenteral dosage is required to maintain adequate blood levels.

Penicillin is also administered locally or systemically. Parenteral administration for common infections requires a dosage of 100,000 or more units daily, divided into 3-hour doses. For topical solutions or ointments containing 500 to 5,000 units per gram are recommended. Daily instillation of from 10,000 to 20,000 units diluted in from 5 to 10 c.c. of spinal fluid or in 10 c.c. of isotonic saline solution is the average dose by intrathecal administration. Two or three times this dosage and volume are necessary for intrathoracic instillation. Peanut oil or oil and wax suspensions of the penicillin, are used to slow absorption on intramuscular injection. For topical application, penicillin powder with dry plasma, or incorporated into an ointment base such as carbowax or purified lanolin, provides a preparation from which the medicament is slowly released.

Claviformin, clavacin, penicillic acid, pyocyanin, fumigatin, streptothricin and streptomycin are also antiobiotic agents which have been developed with a view to finding an agent which is less specific. Streptothricin and streptomycin are the only 2 which have shown clinical possibilities.

c. Streptothricin. This substance is obtained from Actinomyces lavendulae. It showed promise in the early days in the local treatment of infected wounds and burns and in those infections produced by dysentery and Salmonella organisms (gram-negative bacterial infections). Its activity is not influenced by blood, serum, peptone, or B complex vitamins and is not destroyed by gastric acidity. However, it has been more or less overshadowed by streptomycin.

d. Streptomycin (20, 29, 30, 39, 56, 57). This substance was first isolated in 1942 from 2 strains of actinomyces related to Actinomyces griseus. It is soluble in water and possesses a selective action against gram-negative bacteria as does streptothricin, but it is considerably less toxic. Streptothricin possesses some effect on fungi which streptomycin does not. Experiments with in vitro tests and infections in mice have shown that streptomycin is active against a variety of gram-negative and gram-positive bacteria. Streptomycin possesses an effect, therefore, on such gram-negative organisms as the Eberthella, Salmonella, Escherichia, Shigella, Klebsiella, Brucella, Pasteurella, and the Proteus groups. Considerable resistance is shown by some strains of Pseudomas. Sensitivity to streptomycin is shown by staphylococci, hemolytic streptococci, and pneumococci, whereas resistance is exhibited by all members of the sporebearing, anaerobic group. Streptomycin is more effective when administered parenterally. Orally, sufficient dosage will sterilize the gastrointestinal tract of lactose-fermenting organisms. In order to maintain an effective blood level, streptomycin must be injected frequently since it is rapidly excreted by the kidneys. The average daily dose administered, intramuscularly, is from 1 to 3 million units divided into 3-hour doses. Streptomycin is indicated in tularemia, influenza, and Klebsiella pneumoniae infections and as a supplemental aid in peritoneal and urinary tract infections caused by susceptible gram-negative and gram-positive organisms. It has shown some promise in tuberculosis therapy.

Lysozyme (16, 32) a polypeptide, is obtained from tissues and egg white. It destroys a polysaccharide structure of susceptible bacteria. It is possible that other enzymes will exhibit valuable properties in surgery not for their antibacterial activity but because they accelerate digestion of necrotic tissue which provides the greatest inhibition to antiseptics. The bacteriophages were introduced long before the sulfonamides and penicillin. They were used in treating Bacillus coli, Bacillus proteus, Staphylococcus aureus infections and bacillary dysentery. Further investigations of these may reveal new possibilities.

It is with these substances which act by interfering with the essential metabolism of certain organisms that the greatest developments of the future must lie.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

EYE

Hughes, W. L., and Cole, J. G.: Technical Uses of Air in Ophthalmology. *Arch. Ophth.*, Chic., 1946, 35: 525.

The author describes the various uses of air in the diagnosis and treatment of various ocular conditions. In surgical procedures air has been found of value in several ways, namely: (1) in perforating injuries of the cornea; (2) anterior synechias after discission; (3) vitreous in contact with the cornea; (4) cataract extraction; (5) trephination; (6) absence of the anterior chamber after cataract extraction, trephination, or similar operations; and (7) air goniotomy.

A description is given of a new instrument which makes possible the instillation of air and active treatment of synechias at the same time.

A complete discussion of the author's paper, which was read at the Eighty-First Annual Meeting of the American Ophthalmological Society (November 12, 1945) is included. HUNTER H. ROMAINE, M.D.

Parker, F. W., Jr.: Studies on Dark Adaptation in Military Personnel Complaining of "Night Blindness." *Arch. Ophth.*, Chic., 1946, 35: 555.

With the use of the Nagel adaptometer, the author has investigated the complaints of night blindness in a series of military personnel. The findings are summarized as follows:

Sixty-six patients were examined with a Nagel adaptometer for determination of dark adaptation. Careful ophthalmological examinations were made, and neuropsychiatric consultation was secured when indicated.

Thirty-nine patients in the group complained of moderate to extreme night blindness. Fourteen had no ocular complaints, and 13 were patients with hepatitis.

Of the 14 patients with no ocular complaints, all showed normal adaptation curves, and final readings after a period of 45 minutes ranged from 50,000 to 150,000 Nagel units. None had a corrected central vision of less than 20/20, and with homatropine cycloplegia none had a refractive error of more than 1.00 D.

Of the 39 patients complaining of night blindness, 5 with moderate complaints showed normal dark adaptation, and 3 of these had more than—1.50 D. of astigmatism. For 6 others with normal readings but with severe complaints, detailed histories revealed some incident that had caused the patient to believe that his night vision was inadequate. Of this group, 3 patients were found to have moderate myopic astigmatism.

The remaining 28 of the 39 patients who complained of night blindness had initial low readings for dark adaptation. No cause for this could be found in 5 patients, and these men were considered to have true simple hemeralopia; 4 had a pathological condition of the fundus; 5 patients proved to be malingering, and 14 were psychoneurotic.

Of the 19 patients who were malingerers or psychoneurotic, 11 had corrected vision of 20/40 or less, and 12 had refractive errors of above 1.50 D.

HUNTER H. ROMAINE, M.D.

Haik, G. M.: The Management of Intraocular Foreign Bodies in Military Practice. *Am. J. Ophth.*, 1946, 29: 815.

The author discussses the management of intraocular foreign bodies in military practice. In all cases of suspected intraocular foreign bodies and of multiple wounds of the face, a posteroanterior x-ray view of the skull was first obtained, and then a lateral view. The Waters position was used to exclude the confusing shadow of the petrous bone. More accurate localization was then accomplished by two methods: (1) a silver ring introduced into the cul-de-sac (22, 24, or 26 mm. in diameter), and (2) accurate Sweet's localization.

In some cases localization of a foreign body was obtained by the use of four small lead beads sutured about the limbus in four different positions. Injection of air into Tenon's capsule before roentgenological examination clarified conditions in which the foreign body had perforated the eyeball and lay just outside the sclera. Fluoroscopy was disappointing.

Prejudiced adherence to either an anterior or posterior incision is unwise. When the foreign body is more than a few millimeters beyond the posterior capsule of the lens, a posterior rather than an anterior incision is wiser.

After the administration of sodium pentothal anesthesia, supplemented by local analgesia, the foreign body was approached usually through a new incision so placed as to permit the most direct approach to the object, and as near the foreign body as possible because the magnetism of many modern instruments of war is so low that, to be effective, the magnet must be placed near the object.

The author's technique is as follows:

After clearing the affected area of conjunctiva, Tenon's capsule, and episcleral tissue, a black silk No. 4-0 suture is introduced into the sclera as a retractor. Another suture, No. 7-0, is inserted into the sclera just to one side of the foreign body for a depth of 0.1 mm. while a similar suture is introduced on the same level and depth just to the other side. An in-

cision is made between the last two sutures down to but not through the choroid, and the foreign body is removed by magnet or forceps. The sutures are tied, the area about the incision is coagulated with the diathermy needle, and the episcleral tissue and Tenon's capsule are enclosed with silk sutures to avoid superimposing the incisions in the conjunctiva and sclera.

For foreign bodies in the anterior chamber or iris, eserine is instilled preoperatively. If the foreign body has perforated the lens and is in the vitreous, the corneal opening is made large enough to permit removal, and the lens is extracted at a second operation.

The difference between the small and the large magnet is not the increased magnetic attraction of the larger magnet, but the increased size of its magnetic field. A magnet should never be brought to the eye while alive. It is introduced into the wound, as near the foreign body as possible, and the applications are repeated.

Enucleation is now a last resort in the management of foreign bodies. Chemical endophthalmitis is not regarded as an indication for immediate enucleation if the foreign body can not be removed. The infection can usually be controlled by foreign-protein therapy.

Postoperative care consisted of the application of 5 per cent atropine sulfate, sulfanilamide powder, 5 per cent boric acid ointment, and a binocular bandage. At the end of 2 weeks a pinpoint shield was placed on the uninjured eye. Bed rest was required for 7 or 8 weeks. Penicillin was given in the evacuation or field hospital—25,000 Oxford units every 3 hours until 2,500,000 units had been given.

Canned milk and typhoid vaccine were used as foreign-protein therapy.

Modern warfare has caused a greatly increased number of eye injuries, but modern therapeutic methods yield a lower percentage of disability than that of previous wars. Exact localization by roentgenological methods is the secret of successful removal of foreign bodies. JOSHUA ZUCKERMAN, M.D.

Cordes, F. C., and Barber, A.: Changes in the Lens of Embryo after Rubella: Microscopic Examination of an 8 Weeks Old Embryo. *Arch. Ophth.*, Chic. 1946, 36: 135.

Microscopic examination was made of the eye of an embryo 7 to 8 weeks old, from a therapeutic curettement performed 3 weeks after the diagnosis of rubella in a 32 year old primipara. The posterior portion of the eye was normal but showed retardation of development and differentiation of the lens.

The absence of the protection offered by the lids and Descemet's and Bowman's membranes in the cornea during the first 3 months of pregnancy may permit toxic agents to act directly upon the lens by way of the amniotic fluid. No cases of congenital cataract have been reported in which the mother had rubella after the third month of pregnancy, and this may be explained by the presence of these barriers after that period.

It is of interest to note that there have been reported a total of 170 cases of rubella during pregnancy, with congenital defects of the lens in 73 per cent. WILLIAM A. MANN, M.D.

Bellows, J. G.: Influence of Local Antiseptics on Regeneration of Corneal Epithelium of Rabbits. *Arch. Ophth.*, Chic., 1946, 36: 70.

The influence of antiseptics on regeneration of the corneal epithelium in rabbits is described. The author experimentally removed the corneal epithelium from rabbits' eyes and simultaneously treated one eye with a given antiseptic drug and the other eye with normal saline, and in every event the antiseptic drug appeared to retard the rate of regeneration. Some of the following drugs were tried: zinc sulfate (¼ per cent), merbromin (2 per cent), phemerol chloride, mercuric oxycyanide, metaphen, merthiolate, acriflavine, sephiran chloride, penicillin, and sodium sulfathiazole.

The author concluded that in the presence of an infection, penicillin and sulfathiazole should be used.

HUNTER H. ROMAINE, M.D.

Larsson, H.: Results of Radiotherapy of Epibulbar Tumors at Radiumhemmet, Stockholm, 1920–1940. *Acta radiol.*, Stockh., 1946, 27: 358.

The results obtained in 66 cases of epibulbar tumors treated with radium at the Radium Institute, Stockholm, during a 20 year period are reported.

The usual method of treatment was the surface application of a weakly filtered radium preparation. Roentgen treatment in large doses was used in some of the advanced malignant tumors. With the use of surface applications of radium there seemed to be very little damage to the eye. Of the 46 cases treated by this method, only one seemed to show a change which might be attributed to irradiation.

Benign nevoid tumors showed the best response to treatment. Of 14 patients with malignant melanoma, 7 have been free of symptoms for 5 years or more. The majority of patients were treated by a combination of surgery and irradiation.

Numerous cases are reported in which there was no histological basis for malignancy as the author is opposed to biopsy of epibulbar tumors, and believes there is danger of spreading the tumor.

WILLIAM A. MANN, M.D.

Ajo, A.: A Case of Chondroma Bulbi. *Brit. J. Ophth.*, 1946, 30: 465.

The occurrence of cartilaginous tissue as a real tumor or even as part of a mixed tumor in a sound eye is very rare. Cartilaginous tissue generally occurs in eyes which have not developed normally, or in healthy eyes which have been attacked by destructive disease. Cartilage may arise from connective tissue changes of an abscess in the vitreous, or it may arise from the elastic choroid membrane. Hyaline cartilage also occurs in mixed tumors of the lacrimal gland. Two cases of chondroma of the eyelid have been reported in the literature.

The author presents a case of chondroma of the eyeball in a sailor 19 years of age (of Pargas, Finland), who had had poor vision in the left eye since birth. The patient stated that as long as he could remember he had two tumor formations in the conjunctiva, and two gray, opaque spots in the cornea. His vision remained the same until 2 years ago when the eye began to ache and redden; vision became poorer and the swellings enlarged.

The author's description is as follows:

Examination reveals two soft, movable tumors covered with normal conjunctiva. Both tumors continue over the limbus and grow infiltratively into the corneal parenchyma, one resembling rheumatic scleritis in the cornea (a deep wedge-shaped opacity), the other, with its sharp and straight demarcation line and its slight protuberance from the cornea, looks as if the cornea had been covered by a conjunctival flap. Many newly formed deep blood vessels grow out from the upper nasal limbus and stretch right up to the demarcation line of one tumor. The tumor is either congenital or one which developed in early infancy.

There were deep blood vessels in the cornea, but no signs of any sustained inflammation such as posterior synechiae. The histological diagnosis was chondroma without signs of malignancy. The patient refused to undergo an enucleation. It is interesting to report that the tumor grew considerably during the course of 1 year, and the manner of growth was malignant. The patient was transferred to the x-ray department for treatment. His fate is unknown.

JOSHUA ZUCKERMAN, M.D

Leopold, I. H., and Comroe, J. H., Jr.: Use of Diisopropyl Fluorophosphate ("DFP") in Treatment of Glaucoma. *Arch. Ophth.*, Chic., 1946, 36: 1.

Diisopropyl fluorophosphate (DFP) is an anticholinesterase agent of prolonged action capable of producing marked miosis in normal men and animals. In its method of action it is similar to physostigmine, but it is much more powerful. Like physostigmine, it tends to reduce the intraocular pressure in glaucomatous eyes. It has been found that a solution in peanut oil is quite stable but aqueous solutions lose their potency entirely by the seventh day. Peanut oil was found to be nonirritating to the human eye, its only unfavorable effect being a slight momentary blurring of vision due to the oily film. It was not found that the eventual effect of the drug was less in the peanut oil vehicle than in a fresh aqueous solution.

Fifty-two patients with glaucoma in one or both eyes were treated with DFP during a period of 6 months, which represented a total of 78 glaucomatous eyes. All cases were thoroughly studied, with tension curves, visual acuity measurements, and visual field examinations. Most of the eyes had been unsuccessfully treated with the ordinary miotics. Clinical trials indicated that a solution of from .05 to 0.2 per cent was most practicable and that if a 0.2 per cent solution failed to control the tension, stronger solutions were not helpful.

Details of all the cases are presented. In the cases of chronic simple glaucoma, pilocarpine or physostigmine controlled the tension in only 43.7 per cent, but DFP was successful in 89.5 per cent. In glaucoma after cataract extraction, pilocarpine or physostigmine controlled only 40 per cent, whereas DFP succeeded in controlling 100 per cent of ten eyes. DFP was also more successful in eyes with glaucoma secondary to uveitis, but only 6 such eyes were included in the series. In all glaucomatous eyes treated successfully with the ordinary miotics the DFP was also effective and the tension was usually held at a lower level. In 36 of the 78 glaucomatous eyes in which treatment had previously failed, DFP maintained the tension at a point below 30 mm. Hg.

There are several undesirable ocular effects noted, especially blurring of the vision, browache, eyeache, spasm of accommodation, and pericorneal injection. In this series 9 patients were sufficiently bothered by these symptoms as to request a return to their previous medication.

It is as yet too early to stipulate the exact frequency of administration in each case of glaucoma. In some cases instillation may be required only once daily or even once weekly, but this can be determined by repeated checks on the intraocular tension throughout the first 24 hours and daily checks thereafter.

No instance of dermatitis or conjunctivitis has resulted in the cases studied. There was a slight depressant effect on serum cholinesterase in a few cases but no systemic effects which gave rise to any symptoms were noted.

While all cases of glaucoma cannot be controlled by this new drug, it offers promise of becoming a most useful adjunct in the treatment of glaucoma.

WILLIAM A. MANN, M.D.

Leopold, I. H., and Comroe, J. H., Jr.: Effect of Diisopropyl Fluorophosphate ("DFP") on the Normal Eye. *Arch. Ophth.*, Chic., 1946, 36: 17.

The action of the fluorophosphates, especially the diisopropyl derivative (DFP), has been much studied and it is established that it is a powerful inhibitor of cholinesterase, being much more potent than physostigmine in this respect. Because of the possibilities of this drug in the treatment of glaucoma, the authors have undertaken further studies of its pharmacological properties.

In all animals tested, the intense, prolonged ocular miosis following instillation in the conjunctival sac was confirmed, the effect being greatest in man and lasting from 6 to 27 days. In all animal experiments a more prompt and prolonged miosis resulted than from 5 per cent neostigmine bromide. DFP was found to cause a false myopia due to ciliary spasm. In 12 normal eyes the intraocular tension was reduced.

DFP, in the concentrations used, had no direct effect on the iris muscle itself since it failed to con-

strict the totally denervated cat iris. Its effects are due solely to inactivation of cholinesterase.

A 0.1 per cent solution of DFP was able to overcome the cycloplegic effect in human eyes of 4 per cent homatropine hydrobromide. A 0.2 per cent solution overcame the effect of 1 per cent atropine. The latter fact may have practical application since other miotics are considered unsatisfactory for this purpose.

DFP was shown to increase the capillary permeability for fluorescein but not for insulin. A slight decrease in plasma cholinesterase was noted after ocular instillation of DFP, which indicated a minimal systemic absorption. Peanut oil, in which DFP is more stable, did not minimize the effect of the drug. In experiments on cats, an aqueous solution had an earlier, more intense, and more prolonged effect than the peanut oil solution. WILLIAM A. MANN, M.D.

EAR

Popper, O.: Fenestration of the Labyrinth. *J. Lar. Otol.*, Lond., 1946, 61: 24.

A new technical procedure for surgical operations upon the labyrinth and for operations for cholesteatoma of the attic (the transtympanic method) is described. The operative procedure is as follows:

An incision is made in front of the tragus, which is then reflected backwards and incised at its junction with the anterior bony canal wall; the latter is then removed with bone forceps down close to the tympanic ring. This provides a direct exposure of the tympanic membrane, obtained by mastoid approach. A flap is then prepared by an incision through the meatal skin at any selected distance external to the annulus, superiorly and posteriorly. The skin and periosteum are then reflected from the bony canal wall along with the tympanic membrane and are pushed forwards. The middle ear is thereby clearly exposed. The outer wall of the attic is then removed, exposing the epitympanum with the facial nerve and the horizontal semicircular canal. The exposure is a direct one in comparison with the oblique mastoid approach. The incus is removed but the head of the malleus is left in position, its removal being unnecessary. This procedure provides the exposure for the making of a fenestrum either over the ampulla of the horizontal semicircular canal or, as the author points out, in the wall of the vestibule, or in the scala tympana of the cochlea, if desired.

The author describes a new method of making the fenestrum over the ampulla, which consists in trephining a round hole down to the endosteum which is then removed, exposing the membranous canal. It is suggested that such a type of fenestrum is most suitable for insertion of a cartilaginous plug. No clinical experience with fenestrations for improvement in hearing by these procedures is presented but the approach is recommended for any operation upon the middle ear or epitympanic region which does not necessitate a mastoidectomy.

JOHN R. LINDSAY, M.D.

Lindsay, J. R.: Labyrinthine Dropsy. *Laryngoscope*, 1946, 56: 325.

The author reviews the pathological findings in the inner ear in 18 cases of labyrinthine dropsy of the idiopathic type which have been reported since 1938 and adds 2 new cases, 1 of which was diagnosed as Ménière's disease during life. All cases of known Ménière's disease in which a histological examination of the inner ear was made after death have demonstrated a dilatation of the endolymphatic spaces which has been termed labyrinthine dropsy. The clinical syndrome in these cases consists of recurring attacks of vertigo associated with deafness and tinnitus which fluctuates in severity. Deafness, although fluctuating, tends to be progressive and may become profound. Attacks of vertigo vary widely in frequency, duration, and severity, but vestibular function remains relatively active as indicated by vestibular tests.

The histological examination in all proved cases has shown dilatation of the scala media or cochlear duct. The degree of dilatation varies considerably and in the majority of cases there has been a diminution of ganglion cells and nerve fibers in the basal coil of the cochlea. Some cases have not shown this degeneration of neural elements.

Clinically, the deafness affects primarily the low tone range but in many cases the low tone nerve deafness becomes superimposed on a pre-existing high tone deafness of the type usually attributed to primary nerve degeneration.

The pathological disturbance in the vestibular portion of the labyrinth varies considerably. Dilatation of the saccule is fairly constant. One case with rupture of the saccule was presented. Dilatation of the utricle in the regions bordering on the ampullae of the semicircular canals was evident in several reported cases.

The pathogenesis of the condition is not definite nor is the etiology clear. The variation in the pathological picture involving the vestibular mechanism may explain partly the unpredictability of attacks of vertigo. The disturbances of function appear to be explainable to some extent on the basis of the distortion of the membranous labyrinth due to the dropsy but in advanced cases there may also be a related neural degeneration.

NOSE AND SINUSES

Durward, A., Lord, O. C., and Polson, C. J.: Congenital Choanal Atresia. *J. Lar. Otol.*, Lond., 1945, 60: 461.

The authors review a total of 390 authentic cases of congenital choanal atresia, which have been reported. The cases are divided into three groups: bilateral, unilateral, and choanal folds. The pathogenesis and embryology are reviewed and the authors favor the belief that congenital atresia results from a failure in the development at the posterior end of the naris. This is consistent with full palatal development, with the variations in the structure, and the disposition of the membranous

fold to occupy the position of the posterior naris. Bilateral complete atresia may cause urgent symptoms at birth and may result in death from asphyxia. Some infants have a cyclical asphyxia which is relieved by keeping the mouth open; others learn to breathe with the mouth open and have difficulty only while suckling and during sleep. They may suffer from starvation. In the presence of atresia, the affected side of the nose fills with mucoid discharge, but complications due to infection were not common in the cases reviewed. Antral infection and orbital cellulitis were reported in some, and adenoid facies developed.

Operative treatment almost always gives relief. Simple opening of the choannae may produce a cure but usually more radical measures, such as removal of part of the vomer, are also necessary. The time of surgery varies according to the individual patient. The maintenance of nutrition and the risks of asphyxia may demand operation in early infancy. Various procedures have been attempted to prevent reclosure by granulation tissue. The radical method of choice combines perforation of the partition and removal of the posterior part of the nasal septum. Two cases are reported. A bilateral case in a child of three months who showed symptoms of asphyxia after birth, later developed orbital cellulitis and proptosis. The child subsequently died from infection. Microscopic studies of the nasal structures are presented. The second case, a unilateral atresia in a male of 24 years, was treated successfully by perforation of the bony atresia by hammer and gouge and enlargement of the opening by bony forceps. The sinuses were clear to transillumination on both sides.

JOHN R. LINDSAY, M.D.

MOUTH

Fogh-Andersen, P.: Harelip and Cleft Palate. *Acta chir. scand.*, 1946, 94: 213.

In Denmark the surgical treatment of harelip and cleft palate has been centralized to Diakonissestiftelsen's Hospital, Copenhagen, through the State Institute for Defects of Speech. The natal frequency has been found to be 1.50 per mille (193 to 128,306). Nine per cent of the afflicted were stillborn; 12 per cent died within 10 days of birth. The number of patients suffering from harelip and/or cleft palate is judged to be about 4,000 in Denmark, and is distributed as follows: 25 per cent present harelip; 50 per cent, harelip associated with cleft palate; and 25 per cent, isolated cleft palate.

The chief causal factor is that of inheritance. In this connection there are two genetically different deformities, i.e., harelip with or without associated cleft palate, occurring most often in men, with a manner of inheritance that is generally of a recessive character (conditioned dominance); and isolated cleft palate, occurring most often in women, presenting a dominant manner of inheritance. Empirical figures for genetic prognosis show that eugenic measures are generally unnecessary.

A total of 1,000 patients were operated on by Fogh-Andersen from 1934 to 1945. Infants are operated on under a light chloroform anesthetic, and adults under local anesthesia. The harelips are treated according to Veau's method when the infants are 2 months old. In cases of associated cleft palate, the hard palate is closed at the same time. In bilateral cases, each side is treated separately at intervals of from 6 to 8 weeks. Regarding corrective plastics, the technique varies according to the nature of the case.

Thirty-one of the 726 patients operated on for harelip, and 3 of the 537 operated on for cleft palate died after operation. Thirteen of the deaths were presumably due to intercurrent diseases occurring 3 weeks or more postoperatively; 11 of the remaining deaths were due to postoperative hyperpyrexias.

The results of the harelip operations were in the main satisfactory, both as regards the primary operations and the corrective plastics. As to the cleft palate operations the author cannot as yet estimate the results. The anatomical result was generally good, but he cannot judge of the functional result until the children operated on according to the modern technique have attained the age at which they are summoned for speech lessons at the State Institute for Defects of Speech.

NOAH D. FABRICANT, M.D

PHARYNX

Violé, P.: Schwannoma of the Pharynx. *Ann. Otol. Rhinol.*, 1946, 55: 334.

Schwannoma of the pharynx, sometimes called neurinoma or neurofibroma, has been reported only rarely. It apparently develops from peripheral nerve trunks in the neck, is benign, and may appear at any age. It is encapsulated, smooth of surface, usually globular, and is firm and fibrous unless degeneration has occurred. On section, the tumor has a yellowish color, and diagnosis depends upon the histological findings. The cut undersurface is glistening, is of poor vascularity, and the nuclei appear in a palisade-like arrangement. The location is usually anterior to the carotid artery or beneath the upper third of the sternocleidomastoid muscle. Growth is slow and extends over a period of many years. Throat irritation on swallowing may be the first symptom; later a Horner syndrome may appear. Normally, these neoplasms are radioresistant and do not metastasize. The diagnosis requires a full microscopic study and aspiration biopsy is recommended. Differentiation from a carotid body tumor, also of rare occurrence, can be made only on microscopic examination.

JOHN R. LINDSAY, M.D

NECK

Ficarra, B. J.: Struma Lymphomatosa; A Clinico-pathological Study. *Arch. Surg.*, 1946, 52: 729.

In 1912, Hashimoto described a pathological condition of the thyroid, characterized by a diffusely en-

larged hard gland, insidious onset, chronic course, local pressure symptoms, weakness, fatigability, and sometimes nervousness. The basal metabolism is not elevated; there may be symptoms of hypothyroidism. The disease is usually confined to women. Microscopically there is "a dense, diffuse, lymphoid infiltration between the follicles, with occasional formation of secondary (lymphoid) nodules." There is no formation of lymphoid sinuses nor of true lymphoid nodules. Connective tissue is swollen and poorly stained; monocytes and plasmocytes may be found. Occasionally connective tissue predominates over lymphocytic infiltration. The condition is called Hashimoto's disease, or struma lymphomatosa. The disease is rare; only 5 pathologically proved cases were found among 720 thyroidectomies in 3 Brooklyn hospitals. In a fourth hospital, among 1,218 thyroidectomies, 27 cases of "thyroiditis" were reported and, of these, the author concluded that not more than 9 cases could have been struma lymphomatosa.

In diagnosis, the disease must be differentiated from Riedel's struma, chronic nonspecific thyroiditis, chronic specific thyroiditis (tuberculosis, syphilis, actinomycosis), calcified adenomatous goiter, lymphosarcoma, and carcinoma. In Hashimoto's disease, inflammatory symptoms are absent, a specific organism cannot be found, and the gland is hard, not soft. Calcified areas are not seen roentgenologically. It differs from a neoplasm in that there are no palpable nodules, and the gland is not attached to surrounding tissue. The superior poles are extremely broad and the pyramidal lobe is enlarged. It differs from Riedel's struma in that struma lymphomatosa is practically always confined to women; there is myxedema, glandular involvement is diffuse and bilateral, adhesions are absent, the pyramidal lobe is prominent, fibrosis is circumscribed, lymphoid hyperplasia is pronounced, and there are no Dorothy Reed cells.

Subtotal thyroidectomy is the method of treatment. Myxedema usually occurs postoperatively, if not preoperatively; the hypothyroidism should be treated by daily thyroid administration. Postoperative recurrence, which is unusual, is probably due to inadequate removal of diseased tissue.

CLINTON H. THIENES, M.D.

Larsen, K.: Exophthalmic Goiter in Males. *Acta med. scand.*, 1946, 125: 71.

This article is a review of the cases of exophthalmic goiter in male patients admitted to the Medical Department of the Rigshospital, Copenhagen, during the war years.

There was a significant increase in the number of males admitted with this diagnosis; in the period from 1933 to 1936, male patients made up 12.6 per cent of the total number of exophthalmic goiter patients, while in the period from 1941 to 1944 the corresponding percentage was 21.

The author was particularly interested in the cases of masked exophthalmic goiter. He found that the disease was masked in 26 of the 81 men (32.1%) and in 11 of the 93 women (11.8%). He thus concludes that exophthalmic goiter is masked more often in men than in women. F. J. LESEMANN, JR., M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Kozol, H. L.: Pretraumatic Personality and Psychiatric Sequelae of Head Injury: Correlation of Multiple, Specific Factors in the Pretraumatic Personality and Psychiatric Reactions to Head Injury, Based on an Analysis of 101 Cases. *Arch. Neur. Psychiat.*, Chic., 1946, 56: 245.

The author made a detailed study of the pretraumatic and the post-traumatic personality status in 101 civilians with acute head injuries. A clinical quantitative estimate was made of the degree of each of these specific personality factors. It was found that in a number of patients neurotic symptoms appeared for the first time after a head injury. In most patients psychological changes following head injury became most manifest shortly after discharge of the patient from the hospital, and were at a maximum in 3 to 6 weeks after discharge. The duration of post-traumatic symptoms varied but in general they were substantially receding at the end of a period of 3 months. However, approximately 50 per cent of the patients showed some persistence of symptoms at 6 months. The duration of incapacity for work paralleled the persistence of psychological symptoms; but most patients returned to work before they were entirely free of symptoms.

Patients with pretraumatic psychoneurotic personalities showed a greater proportion of post-traumatic psychiatric symptoms than did patients in other groups. However, the patients with pretraumatic normal personalities were closer to the psychoneurotic patients than were members of other groups (psychovariant, psychopathic, etc.).

There was no close correlation between the severity of the acute injury of the brain, the duration of unconsciousness, and the severity of the sequelae, but there was high correlation between the existence of persistent complicating psychological factors, such as continuing compensation, pending litigation, occupational stresses and persistent associated bodily injuries, and the severity and persistence of psychiatric sequelae. The most frequent traits occurring after head injuries were periodic headaches, fatigability, tension, dizziness, emotional instability, anxiety concerning the head, irritability, insomnia, timorousness, abulia, fitful sleep, difficulty in concentration and memory, seriousness, decreased gaiety, excitability, increased need of sleep and the occurrence of nightmares. GEORGE PERRET, M.D.

Pitts, W. R.: The Treatment of Penetrating Wounds of the Brain Produced by Missiles of Warfare. *South. Surgeon*, 1946, 12: 88.

This article is based upon the author's experience as a neurosurgeon with 126 patients presenting penetrating wounds of the brain at a busy evacuation hospital during the Italian campaign in the war just past. It is one of the clearest, most complete, and generally satisfactory reports to come out of the war in the literature dealing with specific types of neural injury.

Considerable stress is rightly placed upon the absolute necessity of careful preoperative study of the patient for his total injury as well as for his specific brain injury, of x-ray study of the skull, of treatment of the state of collapse (not shock) seen in these patients, and the necessity of careful selection of the patients for surgery, according to their obvious prognosis. The point is made that the signs of decerebrate rigidity are almost invariably an indication of the early death of the patient, regardless of what surgical care he may receive. Pitts used local anesthesia (1 per cent novocain) in most of his patients, supplementing this only occasionally by intravenous administration of pentothal in the particularly unmanageable patient. A good account is given of what he found to be the most satisfactory manner in which to handle head wounds in general; and his special treatment for wounds of the dural venous sinuses, the paranasal sinuses, and the cerebral ventricles is described in some detail, yet with comfortable brevity. The use of chemotherapy (as it was then available), postoperative care, and the usual complications are discussed at some length. All of his observations are based on sound surgical principles which need not be applied to neurosurgery alone.

The author makes a strong plea that neurosurgery be just as carefully performed under the conditions of warfare as in civilian practice, stating that the ill effects of careless surgery and rough handling of the brain brings its toll in the wounded soldier just as it does in the sick civilian. One can read between the lines of this article and picture some of the difficulties he must have experienced at times in insisting upon and carrying out his principles of meticulous surgery, which his colleagues know were matters of genuine necessity with him. Such an article would have paid good dividends could it have been in the hands of (1) many young neurosurgeons and (2) hospital commanding officers during the past 4 years.
JOHN MARTIN, M.D.

Martin, J.: The Surgical Problem of Intracranial Aneurysm and Related Vascular Lesions. *Q. Bull. Northwest. Univ. M. School*, 1946, 20: 265.

In a series of 52 vascular anomalies of the brain, 17 were arterial aneurysms, 10 were arteriovenous fistulas, and 25 were congenital malformations. They were considered as a group because of the fact that they presented several common problems of surgical care.

The factor of trauma is one which must always be considered in the etiology of intracranial vascular

lesions. In 2 patients with aneurysm severe head trauma may have been a contributing factor, and 2 other patients were suspected of having had trauma which could have been the cause of the lesion. The other 13 patients had no such history of trauma. In contrast, 6 patients with fistulas had had craniocerebral injuries which were believed without doubt to have been the cause of the lesion; 2 others had had trauma which could have been the cause; and the last 2 had fistulas on the basis of congenital maldevelopment. The congenital malformations were so designated because no known trauma or other cause could be discovered for their existence. In none of the 52 patients was syphilis (present many years earlier in 1 patient with aneurysm) believed to be of any significance. The distribution of all three types of lesions according to sex was without significance, and the age distribution was wide, from 7 to 79 years.

In general, the operative treatment of all three types of lesions was as direct and complete as seemed feasible in the light of the dangers to the patient through attempts at complete eradication, yet it was conservative compared to the methods of treatment in some neurosurgical centers. Of the 9 patients with aneurysm who were operated upon, all had carotid ligation in the neck, and 2 had clips placed on the intracranial aneurysm as well. Carotid ligation with good effect was done in 8 patients with a fistula, and a ninth patient was subjected to ligation of an anomalous vessel in the posterior fossa. Craniotomy with partial dissection, desiccation, and postoperative x-ray or radium treatment were done in 21 patients with congenital vascular anomalies; 2 other patients were subjected to carotid ligation in the neck. A table summarizing the symptoms and treatment of all 52 patients is appended to the original article.

An attempt is made to clarify some of the confusing terms which have heretofore been used to describe the wide variety of congenital vascular anomalies of the brain. Instead of such terms as angioma racemosum, cavernoma, and cirsoid angioma, the lesions have been classified in their simplest anatomical terms. JOHN MARTIN, M.D.

SYMPATHETIC NERVES

Rowbotham, G. F.: Migraine and the Sympathetic Pathways. *Brit. M. J.*, 1946, 2: 319.

The author has postulated that the pain of migraine is probably due either to spasm or dilatation of the arteries of the scalp and dura mater, and that the "sensory arm" of the painful pathways lies in the ophthalmic portion of the trigeminal nerve. He presents the theory that a migrainous person is born with an unstable mechanism in the hypothalamus which reacts excessively to the many stimuli that may reach it, either from the cerebrum or through the blood stream, and thus causes explosive or dysrhythmic messages to be conveyed to the large blood vessels of the head. It is true that the large vessels of the head are supplied with motor fibers from the efferent side of the autonomic nervous system, so that if disordered impulses from the hypothalamus are transmitted to the vessels concerned through the motor autonomic pathways, theoretically, at least, relief should be obtained by section of those pathways.

Four cases of migraine, all with operative treatment, are presented. In 3 patients, who obtained complete relief, the operation consisted of removal of the lower half of the upper cervical ganglion, stripping of the common, external, and internal carotid arteries so as to effect a periarterial sympathectomy (leaving the carotid body isolated but still in place) and then complete ligation and section of the external carotid artery. There was produced, of course, a full-blown Horner's syndrome on the side operated upon. In the fourth patient, in whom the entire upper cervical ganglion was removed, relief was only partial and the pain recurred. The author believes that in that particular patient the unstable mechanism may lie in the vessels themselves, and not in the hypothalamus, or that an error was made in removing the whole, and not just the lower half, of the ganglion. The physiological basis for the last possibility is not explained. JOHN MARTIN, M.D.

Berry, R. L., Campbell, K. N., Lyons, R. H., Moe, G. K., and Sutler, M. R.: The Use of Tetraethylammonium in Peripheral Vascular Disease and Causalgic States. *Surgery*, 1946, 20: 525.

Recently a new method of producing blockade of the autonomic ganglia by means of parenteral injections of tetraethylammonium bromide has been introduced, and the authors' report deals with the use of the drug in peripheral vascular disease and causalgic states.

Observations were made upon the recumbent patient with the extremities exposed to controlled room temperatures. The color and the temperature of the skin and the volume of the pulses were noted in the basal state. Tetraethylammonium bromide was then given either intravenously (100 to 500 mgm.) or intramuscularly (on the basis of 20 mgm. per kgm.), one-half of the total volume being injected into each buttock. The latter route was used only on patients under observation in the hospital. Intravenous injection of the drug caused a metallic taste within 20 seconds, a "cool sensation" in the extremities with definite increase in skin temperature, and incomplete dilatation of the pupil with loss of accomodation. One minute after injection the systolic and diastolic pressures tended to fall, particularly in the hypertensive individual, and there was an increase in the pulse rate. The vasoconstrictor gradient in the extremities was abolished so that toe and thigh temperatures assumed the same level.

In a series of 55 comparative tests of peripheral blood flow, both on patients with peripheral vascular disease and on a control group, it was stated that in 52 instances tetraethylammonium bromide proved equal or superior to the usually accepted methods of

producing sympathetic block, such as paravertebral sympathetic block, spinal anesthesia, and sympathectomy.

In a study of 16 patients with functional angiospastic disorders (Raynaud's disease, 8; acrocyanosis and livedo reticularis, 4; Raynaud's disease with scelerodema, 4) there was a marked rise in skin temperature and an improvement of the clinical picture. In general it did away with the necessity of paravertebral blocks and was of aid in establishing the diagnosis by disclosing the presence of a functional vasoconstrictor component.

A group of patients with organic obstructive vascular disease (thromboangiitis obliterans, 18; peripheral arteriosclerosis obliterans, 55) were observed. Eleven of the patients with Buerger's disease were treated with repeated sympathetic blocks by the drug; of these, 5 are free from symptoms. The remainder of the patients treated conservatively have exhibited a satisfactory decrease in signs and symptoms but have had too brief a period of treatment for evaluation of the end-results. However, in all of the cases the exercise tolerance was definitely increased. Fifty-five patients with peripheral arteriosclerosis obliterans received tetraethylammonium bromide, and from the results obtained it was concluded that one could prognosticate the value which might be derived from lumbar sympathectomy. Many of this group received relief from their nocturnal pain, a relief in some cases even greater than from morphine.

Causalgia, post-traumatic edema, or reflex sympathetic dystrophy was diagnosed in 17 patients. In these there was usually a transient and occasionally a sustained relief of pain on administration of the drug. In addition, it was stated that the drug aided in establishing a diagnosis of reflex dystrophy.

Apparently the drug relieved vasoconstriction by block of the sympathetic ganglia in 9 cases of thrombophlebitis—deep in 6 cases and superficial in 3. However, the effect was extremely variable in duration, ranging from a few hours to several days.

The authors have cited in detail at least one case of each of the types of peripheral vascular dysfunction treated with tetraethylammonium bromide in order to illustrate its effects. They state that they have used the drug 1,000 times in 500 patients without a significant toxic disturbance, and add that most toxic effects, reported elsewhere, have been of a transient type, probably being related to some peripheral circulatory collapse which can be readily corrected by an injection of epinephrine.

RICHARD C. SCHNEIDER, M.D.

De Takats, G., Graupner, G. W., Fowler, E. F., and Jensik, R. J.: The Surgical Approach to Hypertension. Second Report. *Arch. Surg.*, 1946, 53: 111.

The surgical treatment of hypertension in 52 patients by the transdiaphragmatic method of Smithwick including the preoperative and postoperative care, is discussed in considerable detail. The method of work-up is described, as well as the criteria used by the authors as a basis for the selection of cases suitable for operative treatment.

Preoperative medication and anesthesia are discussed in some detail—points which the authors believe are of considerable importance in the operative procedure. The method of operation is also described in detail with illustrations, as well as the method of renal biopsy used by the authors.

A detailed follow-up system has been employed, and a summary of the results is tabulated. Cases have been divided into three groups: (1) those in which there was a clear cut indication for operation as indicated by preoperative studies; (2) those in which the operative indications were relative and debatable; and (3) those in which there was premalignant and malignant hypertension, which cases were regarded as not suitable for operation.

In 17 patients in the first group, the response was considered very good, and in only 2 was there recurrent hypertension, which was corrected after completion of a technically incomplete operation. Six patients showed recurrence in the second group. These recurrences were analyzed, and reasons were found for the organic, irreversible lesions which could be detected preoperatively.

The authors concluded that at this time no single or combined method of treatment can be identified as one which would give rigidly selected patients with hypertension as much benefit as the transdiaphragmatic splanchnic nerve section combined with dorsal lumbar sympathetic ganglionectomy.

HOWARD A. BROWN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Lamont, E. S.: A Two-Stage Mastopexy in Plastic Surgery of Markedly Enlarged Breasts. *Ann. Surg.*, 1946, 124: 111.

The author states that of necessity excessively enlarged breasts often require surgical help. Frequently, because of the marked increase in size a one-stage mastopexy is impractical to obtain the desired results; two-stage procedures frequently do obtain the desired results.

The purpose of surgery is four-fold: (1) to obtain small breasts with reasonable size, shape, symmetry, and contour; (2) to construct two nearly identical breasts; (3) to obtain intact nipples and other areolae in the desired position; (4) to avoid loss of tissue following surgery.

When breasts are of exaggerated size, the two-stage operation will meet all of these requirements and reduce variations to a minimum. Because such large breasts are usually functionless, the prime purpose of the operation is to obtain small breasts of the desired proportions. A two-stage operation with transplantation of the nipple may be utilized in such cases.

The author describes a two-stage technique with a great number of illustrations, and summarizes it as a method which allows for plastic reconstruction of excessively enlarged breasts with a minimum danger of losing any tissue. At the same time the procedure presents sufficient elasticity so that the surgeon may create small breasts of the desired proportions from an exaggerated deformity. Gentleness in handling tissues, meticulous surgery, careful planning of the surgery, and a knowledge of surgical anatomy are presupposed. PAUL MERRELL, M.D.

Haagensen, C. D., and Stout, A. P.: Granular Cell Myoblastoma of the Mammary Gland. *Ann. Surg.*, 1946, 124: 218.

Although granular cell myoblastoma is most commonly seen in the tongue, it may occur almost anywhere in the body and at any age. The authors have observed 5 cases in the mammary gland. Here it must be distinguished from carcinoma which closely resembles it.

These 5 cases are described in detail because the authors believe that they illustrate certain features which may be of aid in the diagnosis of myoblastoma of the breast. The authors believe this condition of the breast to be a benign tumor, but agree that it is impossible to ignore the fact that it may on occasion become malignant and metastasize. They believe that this condition occurs in the breast and produces all the symptoms of early carcinoma, for which it may be mistaken and the breast needlessly sacrificed. The myoblastoma is easily recognized in a good frozen section. EMIL C. ROBITSHEK, M.D.

Sjövall, H.: The Clinical Picture and Therapy of Rib Tuberculosis (Zur klinik und therapie der rippentuberkulose). *Acta chir. scand.*, 1946, 94: 33.

The author has chosen for his discussion a series of 75 cases of tuberculosis of the ribs, observed at the surgical and orthopedic services of the University of Lund between the years of 1919 and 1938. The series was chosen because it permitted an adequate follow-up. Of the 75 patients, 45 were males and 30 were females—a ratio of 3 to 2. The average age of the patients in this series was 39 years, which is far higher than the average age of a similar group of patients with extrapulmonary tuberculous lesions other than of the ribs. In this regard, some significance may be attached to the fact that most of the patients were derived from a rural district where bovine tuberculosis was not uncommon.

The cases of rib tuberculosis fell into two main groups: in one group the rib involvement was but a part of a tuberculous process and in the second group the rib involvement was the primary and sole site of the disease. Thirty-one, or 41 per cent of the patients, had another clinical tuberculous lesion, while in 16 there was a site of bone or joint tuberculosis.

Since the prognosis in rib tuberculosis is generally considered to be good, it was a surprise to the author at the time of investigation to find that of his series of 75 patients, 34, or 47 per cent, had died. Moreover, of the dead, 62 per cent had died of tuberculosis.

Etiologically it was interesting to observe that 13 patients gave a definite history of trauma preceding the onset of the symptoms by a day or a week, and in half of these a palpable tumor was discovered within a week of the trauma. The authors feel that the occurrence of the injury merely called attention to the area of involvement in these patients. The symptoms were pain or the presence of a tumefaction. In 2 of the cases, the differential diagnosis between the lesion and breast cancer was considered. In 1 case there were acute symptoms which simulated a cholecystitis. In most instances, however. the process took the form of a typical cold abscess. The roentgen film was most productive, the diagnosis being established roentgenologically in 21 patients.

Sixty-one of the patients were treated surgically. Three methods were used: simple incision, incision plus curettement, and resection of the involved segment of rib. In all 3 groups, reoperation was necessary in some of the cases, but the smallest number of reoperations were required in those patients who had been subjected to rib resection. In this instance, the rib was resected and the wound closed primarily. Of 44 patients so treated, healing occurred either by primary intention or soon thereafter in 31. Recurrence developed in but 3 of this group. However, 20

of the patients were dead at the time of this review. Among these were the unhealed and recurrent cases. Furthermore, the poor results in the last group were largely among those patients who had manifest tuberculosis in other parts.

The authors conclude that rib tuberculosis is best treated by rib resection, but even with this treatment the prognosis both for healing and for eventual life should be guarded. WILLIAM C. BECK, M.D.

TRACHEA, LUNGS, AND PLEURA

Curtillet, E., Grasset, and Houel, J.: Hemothorax Walled Off by a Fibrinous Deposit; Impenetrable Hemothorax (L'hémothorax cloisonné à dépôt fibrineux, hémothorax imponctionnable). *J. chir.*, Par., 1946, 62: 5.

The problem of hemothorax has never received the attention that it deserved in the surgery of pleuropulmonary wounds; it has received surgical consideration only when it was thought to be septic. The problem of the evolution and sequelae of hemothorax is examined by the authors, especially as it develops into the so-called "clotted hemothorax" which cannot be evacuated by thoracentesis because it is surrounded by a tough impenetrable fibrinous wall.

The recent war has revived the problem of the clotted hemothorax. It has been estimated that between 10 and 20 per cent of hemothoraces evolve into this pathological entity.

In the clinical X-ray study of traumatic hemothorax one sees an opacity at the base or lower third of the chest which may be resorbed in the space of 2 to 4 weeks if no infection occurs; this density may occur as high as the sixth interspace or higher and may be accompanied by pneumothorax and pulmonary embarrassment. Pulmonary collapse without effusion is suggestive. Symptoms are those of a pleural effusion—cough, pain, dyspnea—but generally they are not so severe. During the early stages these hemothoraces may be punctured and evacuated, but after 8 or 10 days, if no infection supervenes, the situation may be very different. Although even then a complete evacuation of the bloody fluid may be accomplished, one may also encounter an impenetrable hemothorax. Clinically and roentgenologically the signs are identical with those of simple hemothorax, and the dry tap alone reveals its presence. Perhaps only a few cubic centimeters of fluid are evacuated from a cavity that appears massive in the roentgenogram. The opacity may be mistaken for a congested lung, but this may be ruled out by lack of physical signs, and by failure to evacuate fluid by thoracentesis.

Surgical exploration regularly reveals astonishing and characteristic lesions. On opening the thorax, one finds thick cords and strands of fibrous tissue forming a mass between the lung and pleura and enmeshed with blood. The lesion has the appearance of a vaginal hematocele—it indeed is an immense hematocele—and thus a dry puncture is explained. When the hematocele is removed with the fingers and a knife, one finds a well delineated cavity. The adjacent lung does not lose its ability to re-expand; and the re-expansion can be accomplished by insufflation. After the twentieth day, however, exploration with a knife reveals the existence of a rigid fibrous wall 1 to 3 mm. thick which must be excised to free the lung. It is important to emphasize that the pleura and the lung parenchyma are normal under this capsule.

With regard to the pathogenesis of this lesion, it must be emphasized that the blood which escapes into the pleural cavity does not clot, and at first is poor in fibrinogen. However, the amount of fibrinogen in the hemothorax increases slowly and the latter takes on a fibrous character. Time is an important factor in its development, although not all hemothoraces are destined even in time to undergo fibrinous change and become walled off. English authorities have postulated a humoral mechanism set off by the puncture wound which prevents coagulation. However, the authors believe that an attendant attenuated infection is the important factor in its development. This low grade infection sets up a reaction in the fibrinogen-rich serous surfaces of the pleura which accounts for the fibrinous character of the lesion.

Bacteriological studies in 17 cases revealed the presence of bacteria in these lesions—streptococci, staphylococci, and other gram-positive bacilli. There has been a definite increase in the incidence of walled-off hemothorax since the advent of sulfonamides and penicillin, the generalized use of which has attenuated many strains of bacteria; all of the patients had received either one or the other drug.

In some cases these hemothoraces eventually become absorbed, but in other cases serious sequelae (retraction of the thoracic cage, scoliosis, or reduction in vital capacity) occur after some months. This has been observed in several cases followed up since World War I. The authors conclude that a known case of walled-off hemothorax demands prompt surgical intervention.

The surgical procedures which may be employed are three: thoracentesis, thoracotomy, and decortication. To wait longer than a day or two before thoracentesis is done allows the walling off process to occur; the fear that an early puncture will result in a new hemorrhage is unfounded, as the authors' experience has shown. Sometimes a seroalbuminous exudate appears following an initial puncture, or a new density is seen in the roentgenogram; this calls for a new puncture and a search for organisms. The most optimum time for thoracentesis is the third day, but this is not always practicable in the exigencies of war. Several successive punctures may be done and spaced from 24 to 48 hours apart, or a Monad trocar may be left in place and the chest tapped successively with only one initial puncture. Lavage of the pleural cavity with physiological serum aids in clearing up the lesion.

A walled-off hemothorax which cannot be evacuated by thoracentesis is a definite indication for

thoracotomy. Generally, if it is done under 10 days, it is sufficient to evacuate the fluid, remove all adhesive fibrous strands and clots, with the hand within the pleural cavity, and re-expand the lung by insufflation. A drain is left in place.

If the patient is seen from 15 to 20 days after the injury, then one may predict that the pleural cavity is lined by the strong fibrous shell described and the lung incapable of expansion (proved by a trial insufflation). The fibrous wall must then be removed by careful dissection, i.e., the lung must be decorticated until it re-expands under insufflation. Although penicillin has reduced the risks of postoperative infection, decortication is still a formidable procedure and can generally be avoided if thoracotomy and early cleaning out of the thoracic cavity is done.

PHILIP B. CHASE, M.D.

Moore, R. L.: War Injuries of the Chest. *Ann. Surg.*, 1946, 124: 367.

Chest wounds comprise from one-fourth to one-third of all battle casualties and about one-twelfth of the wounds of soldiers that survive admission to medical units. The relatively low mortality rate for chest injuries in the present war as compared with all previous wars attests to the high quality of the therapy applied.

The proper treatment of thoracic wounds demands that the physiological alterations which accompany them be well understood. These may be due to: (1) open pneumothorax, usually associated with "sucking wounds" of the chest wall; (2) tension pneumothorax; (3) surgical emphysema, either superficial or mediastinal; and (4) cardiac tamponade. All or any of these may be associated with a chest injury. Therefore it is most essential that they be kept in mind when a patient with a chest wound is first examined. All of them may be serious and if overlooked may lead to deaths which could have been prevented. The initial treatment of thoracic injuries consists mainly in combating shock, the proper care of the wound, and correcting these physiological disturbances.

Open pneumothorax. The high mortality which followed early open drainage in the streptococcal empyemas of the last war was later proved to be due to the ill effects of the open pneumothorax that was produced by operation. When this method of treatment was changed and the pleural fluid in the early cases was evacuated by repeated aspirations rather than by open drainage the mortality fell from about 50 per cent to about 5 per cent.

When a hole is torn in the chest wall by a shell fragment or bullet, the effect is exactly the same as that of the establishment of open drainage in the early or acute stages of an empyema. Air is sucked in through the opening with each inspiration. The intrapleural pressure rises and the expansion of the lung is reduced. In order to compensate, the patient breathes faster and with greater effort and this, in turn, rapidly leads to exhaustion. Open wounds of this kind, so-called "sucking wounds," should be closed as soon as possible. Experience has shown, however, that closure by suture is inadvisable unless all of the necessary surgery has been completed. When the existing facilities are inadequate for this, or trained personnel is not available, treatment in general should be limited to first-aid measures; namely, control of shock, control of hemorrhage, excision of devitalized and soiled tissue, and removal of readily accessible foreign bodies. The wound is then covered with a pad of vaselined gauze. This is either sutured to the skin, or strapped in position with adhesive plaster. In most instances this method will suffice until the soldier can be delivered to a suitable hospital for definitive operating.

Tension pneumothorax. When a lung is pierced or torn or, more rarely, when a bronchus is lacerated, air may repeatedly be sucked into the pleural cavity during inspiration, and trapped. The opening, acting as a ball-valve, allows the air to get in, but does not allow it to get out. Under these conditions, the intrapleural pressure steadily increases and the resulting tamponade effect may reach alarming proportions and seriously interfere with both pulmonary expansion and the filling of the right side of the heart. This leads to severe dyspnea and in extreme instances to acute circulatory failure, evidenced by a falling systemic pressure, a high venous pressure, and a weak rapid pulse, pallor and sweating. In civil practice this condition, known as a tension pneumothorax, is occasionally seen after pneumonectomy or lobectomy, when the closure of a bronchial stump or lung is insecure or gives way in the presence of infection. It may also follow rupture of an emphysematous bulla. It is more likely to be due to laceration of the lung or bronchi by fragments of broken ribs. The immediate treatment is very simple: The pressure can be relieved quickly by introducing a needle with a flange, which can be readily strapped to the chest wall. If such a needle is not available, a flange can be improvised by using an ordinary cork. The needle is inserted through the cork, which in turn is fixed to the chest wall with adhesive strapping. The second intercostal space in the midclavicular line is a convenient location for introducing the needle. If left in position, the needle should be connected with a "water-seal."

Surgical emphysema. Surgical emphysema is superficial or mediastinal. The superficial variety may result from laceration of the lung by in-driven rib fragments or penetration of the lung by a missile. In either case air escapes into the subcutaneous tissues, either directly from the lung at the site of an adhesion, or indirectly through the medium of an interposed pneumothorax. From the chest wall the air may spread upward to involve the tissues of the neck and face, or downward to the abdominal wall, or even to the extremities. The diagnosis is readily established by the crackling sensation which one gets on palpating the involved areas and the air in the tissues is easily recognized on roentgenograms. The condition rarely demands any special treatment because the opening in the pleura usually becomes

sealed after a short period of time and the air in the tissues is readily absorbed. If the pleural opening does not close, however, and the condition becomes progressive and causes symptoms, relief should be obtained by introducing a needle into the pleural space for the escape of the air.

Mediastinal emphysema is a much more serious condition because air escaping into the mediastinum does not find a ready outlet and there is serious danger of compression of the great vessels and even the esophagus. Here the air escapes from a lacerated trachea or large bronchus and tends to spread toward the neck.

This condition is readily recognized from a soft swelling in the suprasternal notch and the diagnosis can be confirmed roentgenographically. Radical treatment is indicated only when the symptoms of compression are severe enough to endanger life. Treatment is directed toward relief of pressure. A thoracotomy may be necessary, followed by incision of the mediastinal pleura and suture of the lacerated bronchus or trachea.

Cardiac tamponade. Cardiac tamponade refers to acute cardiac compression caused by the rapid accumulation of blood or exudate within the pericardial sac. Since the pericardium is a dense, fibrous, relatively inelastic membrane, it is not distended appreciably by an acute increase in pressure. The pressure of the fluid obstructs the filling of the heart and the blood is dammed up in the great venous reservoirs of the body. Should the intrapericardial pressure equal the effective venous pressure, the blood can no longer enter the right auricle and death follows. The clinical picture is that of circulatory failure.

In chest injuries, the syndrome is caused by intrapericardial bleeding which usually results from a stab wound in the front of the chest to the left of the sternum, in the third or fourth interspace. The source of the bleeding is most likely to be the right ventricle or the anterior descending branch of the left coronary artery.

Treatment demands the greatest haste, to relieve the pressure and to stop the bleeding. The time required for roentgenologic and fluoroscopic examinations, and long preparation, might mean the difference between life and death.

Hemothorax. Hemothorax occurs in 70 per cent of all chest injuries in modern warfare. Notwithstanding, the treatment has been a subject of much discussion. Some have advocated extreme conservatism, aspirating only to relieve pressure or pain. Others have advocated aspiration with air replacement, and still others, aspiration alone. This latter method, with a view toward emptying the pleura as quickly and completely as possible, is now widely approved as the treatment of choice.

When a hemothorax cannot be controlled by aspiration because of clotting, the proper treatment is an early thoracotomy with evacuation of the blood clot. The treatment of chronic hemothorax by excising the fibrous membrane covering the underlying lung appears to have reduced the incidence of chronic empyema in the present war.

Wounds of the chest wall. The treatment of wounds of the chest wall does not differ from the treatment of similar wounds in other parts of the body except that chest cases should have a high priority among battle casualties, and should be taken as quickly as possible to an installation with complete anesthesia and operative facilities, preferably one with personnel experienced in thoracic surgery. Endotracheal anesthesia should be routine in all intrathoracic procedures, and facilities for suction should be available. The wounds should not be sutured until all of the surgery, necessary at the time, has been completed. Suturing then should be directed primarily toward closing the pleura. When it is necessary to approximate muscle and fascial layers of the chest wall these structures should be sutured loosely. The skin and subcutaneous tissues should be left open.

Perforating wounds. The treatment of through-and-through bullet wounds of the chest which cause slight pulmonary damage and do not injure large blood vessels or other important structures consists mainly of the treatment of hemothorax.

Penetrating wounds with retained foreign bodies. In treating these injuries the risk of the operative procedure which would be required for removal of the foreign body has to be balanced against the risk of complications which are likely to develop if the foreign body is left in place. Experience has shown that pieces of clothing and fragments of bone are especially likely to lead to serious infection and every effort should be made to remove these. On the contrary, metallic foreign bodies are well tolerated. Nevertheless, it is thought that these should be removed also when they are large (diameter of 2 cm. or more) and causing symptoms, when free in the pleural space with hemothorax, or, because of their position, considered to be a threat to vital structures such as the heart, esophagus, and large blood vessels.

Thoracoabdominal wounds. Whenever a missile penetrates the thoracic cavity the possibility of its having traversed the diaphragm and entered the abdomen must always be borne in mind. This is particularly important if the thoracic wound is low, in the region of the diaphragm. Roentgenograms of the abdomen as well as of the chest should be taken regularly. When operation is being planned, careful consideration should be given to all the facts relative to both the thoracic and abdominal wounds. There is no standard procedure that can be applied in all cases.

Infected war wounds of the chest. The treatment is as follows: (1) pleural and pulmonary suppuration are forestalled by early operation (within 6 to 10 hours), removal of foreign bodies, local and systemic use of the sulfonamides or penicillin, and leaving the superficial layers of the wound in the chest wall open; (2) infected hemothorax in the early stages is properly treated by aspiration. Thoracotomy with rib resection (open drainage) should be postponed until

the pleural exudate is definitely purulent; and (3) pulmonary or pleuropulmonary suppuration secondary to retained foreign body should be treated first by drainage. STEPHEN A. ZIEMAN, M.D.

Wylie, R. H., Hoffman, H. L., Williams, D. B., and Rose, W. F.: The Thoracoabdominal Casualty. *Ann. Surg.*, 1946, 124: 463.

This report reviews the case records of 903 thoracoabdominal casualties in the Forward Hospital of the second Auxiliary Surgical Group during 1943, 1944, and 1945.

The term thoracoabdominal wound refers to a wound produced by a missile perforating the diaphragm and entering the pleural and peritoneal cavities. Casualties in which the pleural cavity and peritoneum have been entered by separate missiles without injury to the diaphragm are excluded. Thoracoabdominal wounds comprised 25.5 per cent of the abdominal cases treated surgically at this hospital.

The pattern of entry of the fragments or bullets in thoracoabdominal wounds shows that 837 of the missiles entered through the abdomen. The entrance wounds in the chest were equally distributed on the right and left sides.

The intelligent regimen of resuscitation and treatment depends on the early recognition of the thoracoabdominal feature of the wound. For practical purposes, any perforating fragment which crosses the horizontal zone bounded by the plane of the costal margin and twelfth rib below, and the line between the nipple and the angle of the scapula above may perforate the diaphragm. When a penetrating wound was present, roentgenological examination was a necessity. Further clinical examination of the casualty was directed at an evaluation of the cardiorespiratory status. However, in thoracoabdominal wounds less time could be devoted to stabilization of the cardiorespiratory physiology than in the purely thoracic cases. Of prime importance in combating shock and saving life in thoracoabdominal wounds is early operative treatment. Examination and all necessary preoperative therapy were done in the so-called shock tent.

With the movement of the casualty from the shock tent to the operating tent by stretcher the operative phase of management begins. It deals with the anesthesia, pathology, operative approach, and procedure. In nearly all cases, maintenance anesthesia was achieved by endotracheal ether and oxygen in a closed circuit. Injury to the lung was described as contused, containing hematoma, or as perforated or lacerated. Because of the path of the missile through the lower part of the chest in the diaphragmatic zone, the peripheral portions of the lower lobes, and less frequently of the middle lobe and lingula of the left upper lobe, were injured.

The injury to the diaphragm was a single or double small perforating wound, the large lacerated wound, or the avulsion of the diaphragm from its chest wall attachment. Similar to the chest wall, the right and left sides of the diaphragms were wounded quite equally.

In the peritoneal cavity the liver took the impact of the missiles entering through the right diaphragm. In order of frequency, the right kidney, the colon, the stomach, the small bowel, the duodenum, and the gall bladder were wounded on the right side.

The anatomic relationships below the diaphragm have a direct bearing upon the operative approach and procedure on the right or left side. Any discussion of methods of approach must be qualified at the onset by the statement that no one approach is ideal for all patients, and the judgment of the surgeon, who knows the individual patient and his own capabilities, decides the approach to be used by himself. In general, when a thoracotomy and celiotomy were both contemplated, the chest procedure was performed first, because the patient stood a celiotomy better after the chest wall and diaphragm had been closed and the lung re-expanded. How much surgery should or can be done through the chest and diaphragm, and how much through the abdomen, again depends upon relative factors.

Thoracotomies, as performed, were of four types: (1) a limited thoracotomy achieved by extending the missile wound; (2) a thoracotomy through the area of the wound; (3) a thoracotomy outside the area of the wound; and (4) a so-called combined thoracoabdominal incision, in which the thoracotomy was extended through the costal arch and down through the abdominal musculature.

The closure of the diaphragm is of utmost importance both on the right and left sides. Suture of the left diaphragm is imperative to cut off the path of contamination and infection from the peritoneal cavity, and to prevent herniation of the abdominal viscera into the pleural cavity. It is, likewise, mandatory to close the right diaphragm to prevent the occurrence of bile pleuritis and empyema, and also to keep contamination and infection from invading the pleural cavity. A firm closure was insured by interrupted silk sutures.

Specific treatment of individual organs of the abdominal cavity revealed that wounds of the stomach and duodenum were sutured, wounds of the colon were exteriorized, wounds of the small bowel were treated by suture or by resection and anastomosis, of the spleen by splenectomy, and of the liver by subcostal drainage. Wounds of the kidney were treated by nephrectomy only when hemorrhage was persistent, or the pelvis involved, otherwise drainage sufficed. Treatment of the pancreas was by suture and drainage, or by drainage alone. The celiotomy incision was either a right or left rectus, and closure invariably entailed some type of retention suture.

The postoperative care of the patient with a thoracoabdominal wound entails attention to details of care common to both the chest and the abdominal patient.

The postoperative care of the chest is directed toward maintaining cardiorespiratory balance, promoting expansion of the lung, and removal of blood

and air from the pleural cavity to allow full expansion and to minimize the chances of pleural thrombus formation.

The postoperative care directed at the abdominal part of the wound emphasized the importance of nasal tube stomach siphonage, up to 4 days, in accord with the re-establishment of peristalsis to the surgeon's satisfaction. Use of stomach siphonage indiscriminately beyond the period of 4 days may veil a bowel obstruction, and delay recognition and correction of it.

An accurate knowledge of the daily intake and output of the patients is imperative. During the period in which nasogastric siphonage was in use between 2,000 and 3,000 c.c. of 5 per cent glucose in saline solution were given to these patients daily. Caution should be exercised in giving a total amount of parenteral fluids in excess of 3,000 c.c. daily because of the impaired cardiorespiratory reserve which may exist, and the possibility of producing pulmonary edema.

Sulfonamide and penicillin therapy were employed from the time of wounding through the postoperative period. Complications recorded in order of frequency were atalectasis, empyema, subphrenic abscess, and pneumonia. Bronchopleural fistula was reported 4 times, twice with empyema, and twice with bile empyema. Pressure pneumothorax occurred in 3 instances as a postoperative complication.

The gross mortality for the 903 cases with thoracoabdominal wounds was 246, or 27.3 per cent.

STEPHEN A. ZIEMAN, M.D.

Shefts, L. M., and Doud, E. A.: The Management of Thoracic and Thoracoabdominal Wounds in the Forward Areas in the Sicilian and Italian Campaigns. *J. Thorac. Surg.*, 1946, 15: 205.

The method of treatment, and the immediate results of 64 thoracic and thoracoabdominal war injuries with wounds limited to the chest wall, are reported. The cases were selected from a group of 200 patients who had been treated by a team of the Second Auxiliary Surgical Group during a 20 month period commencing with the invasion of Sicily. The patients were evacuated from this first priority field hospital to the chest center of a base hospital in from 8 to 15 days following emergency surgery; therefore the results are uncorrected for the development of subsequent complications and for lethality of concomitant wounds.

Bullets tended to involve more than one celomic cavity and, because of wobbling or high compression wave, to cause contusion of organs and extensive pulmonary hematoma. High explosive fragments have greater tearing action.

Preoperative intercostal nerve block, covering two segments above and two segments below the wound in the chest wall, permits a painless cough to clear the tracheobronchial tree. If cough is inadequate, endotracheal catheter suction is used at once. Intravenous fluids are given only after an open airway is established. Hemopneumothorax, encountered in 159 of 200 cases, was treated by immediate thoracentesis with autotransfusion of strained citrated blood, when feasible. True, progressive tension pneumothorax was rare in this series, perhaps because air leaks were sealed by hematoma at the site of the tear. Sucking wounds were dressed with large occlusive petrolatum packs. After resuscitation, fluoroscopy for position of the missile and for cardiac tamponade was done. Roentgenograms can usually be made in the upright position.

Intra-abdominal injury can be postulated from the position of the wound of entrance, position of the missile, and failure to respond to shock therapy. Deep shock occurs in intraperitoneal hemorrhage, in gross contamination of the left pleural cavity by contents of the large bowel, in shattered spleen, or in wounds of the right lobe of the liver. Immediate exploration is indicated after insertion of a Levine tube in the stomach.

Surgical treatment of penetrating and perforating wounds is based largely on the presence or absence of continued intrathoracic hemorrhage, and ranges from local debridement and closure to extensive surgical procedures. Rarely is thoracotomy done because of the presence of missiles. They are removed if convenient, or if they lie in a position which is dangerous to life—the hilus of a lung, the mediastinum, or near the esophagus. Torn pulmonary parenchyma is rarely sutured.

Traumatic thoracotomy arbitrarily means excavated wounds, palm sized or larger, involving the pleural cavity. Treatment is designed to eliminate paradoxical motion and permit closure, without tension, with nonabsorbable material for fixation against cough until the wound is solid, gross contamination notwithstanding.

Thoracoabdominal wounds in which a single missile involves the pleural cavity, diaphragm, and peritoneal cavity are discussed as left and right sided penetrating and perforating wounds, and the optimum surgical approach for each is outlined.

The technique of approach to mediastinal structures, the control of hemorrhage, and the details of mediastinotomy are presented. The prevention and treatment of infection of the subscapular space in chest wall wounds is considered. The prognosis in combined thoracic and spinal cord injuries, with the level of anesthesia higher than the umbilicus, was found to be hopeless because of paralysis of the recti and ineffective cough.

The postoperative goal is a completely expanded lung. It may be achieved by the anesthetist in conjunction with pleural lavage at the time of closure, and maintained in the presence of a clear tracheobronchial tree. Energetic cough routine is supplemented by intercostal nerve block when pain is an inhibitory factor. Tracheal toilet with catheter suction and bronchoscopy are freely used postoperatively. Oxygen may be used for short periods.

With an open airway established, endotracheal anesthesia with pentothal or nitrous oxide induction

is used with ether for maintenance. Endotracheal catheter suction during surgery, to prevent spill-over of secretions, and postoperative bronchoscopy are essential. LYNN JOHNSEN, M.D.

D'Antona, G. G., and Fojanini, G.: Pleural Complications in the Course of Suppuration of the Lungs (Sulle complicanze pleuriche in corso di suppurazioni polmonari). *Policlinico, sez. chir.*, 1946, 53: 45, 91.

In abscesses of the lung the pleura may become involved by direct extension, or through the lymphatics if the abscess is near the surface. In the lung the lymphatics near the surface run toward the pleura while the deeper ones run inward, but in deeper abscesses the lymphatic current may become reversed by its being blocked and carry infectious material to the pleura. And, of course, in operation on the lungs infection may be disseminated.

From November, 1938 to October, 1943, 198 cases of suppuration of the lung were admitted to the University Hospital of Rome. Among these, 61 (30.8%) presented pleural complications of various types and in 7 of these the complication was bilateral, which made the total number of complications 68. The mortality of pleural complications in these cases was 8.58 per cent, the total mortality being 26.6 per cent. There was a total of 52 deaths, 17 of them, or 32.69 per cent, from pleural complications. Of the deaths from pleural complications, 6, or 35.2 per cent, were due to simple empyema and 11, or 64.7 per cent, to putrid empyema. In 4 other cases the pleural complication was not the direct cause of death, death being due to hemorrhage in 3 cases and to diffusion of the lung process in 1 case.

The localization of the pleural complications is discussed in detail and illustrated. Histories of a number of the cases are given.

In only 1 of the cases was the empyema bilateral. It has been claimed but not demonstrated that there are direct lymphatic communications between the two sides of the pleura. It is true that the empyema may mask an unrecognized lung abscess, and although such abscesses can be located by roentgen examination, this is not always true and it may be necessary to make the diagnosis from the history. Serofibrinous pleurisies are generally benign and have a marked tendency toward spontaneous absorption. A rise of temperature after operation which is prolonged and tends to reach a considerable height indicates the possibility of a developing pleural complication. Puncture of the pleura should be performed very carefully in such cases. If the fever persists for too long it indicates the transformation of a serofibrinous pleurisy into a purulent or putrid one. In serohemorrhagic pleurisy, puncture gives a red fluid.

In seropurulent pleurisy the pleural reaction is more intense and the clinical picture more marked. The fever is higher and remittent and the patient's general health is affected. The exudate may increase to such an extent as to cause dyspnea and symptoms from displacement of the mediastinum. The course is longer than in the preceding forms. In purulent pleurisy the patient has violent pain in the affected side of the thorax and dyspnea. The general condition grows worse rapidly. The physical signs are very marked in these cases. In putrid pleurisy the symptoms are much the same but more violent; there may be severe toxicosis as the process progresses.

Roentgen examination is used to differentiate between sacculated pyopneumothorax and suppurative lung cavities. Illustrative roentgenograms are given. Lung cavities are generally situated in the peripheral part of the organ, most frequently in the lower right lobe. When infectious material is aspirated it passes more readily into the right bronchus than the left because the former follows more nearly the direction of the trachea. Large areas of air and fluid are more apt to be of pleural than of pulmonary origin. If fragments of tissue project into the clear area they are apt to be of lung tissue and the condition is a lung cavity. The surface is smoother in hydrops of the thorax than in lung cavity. In empyema beyond the limiting band the lung tissue is normal while in lung cavities the passage from diseased to normal tissue is gradual. The angle of the circular shadow with the wall of the thorax is acute in pneumothorax and obtuse in cavity. There is no absolutely certain differential roentgen sign between these two conditions but a number of signs which taken altogether generally suffice for differentiation. In making the roentgen examination the patient should be placed in the position he will assume on the operating table; anteroposterior and laterolateral views are taken.

In order to decrease the very serious mortality in this condition there should be close collaboration between the physician, surgeon, and roentgenologist. The patients should be sent to the surgeon at once without waiting for pneumothoracentesis or treatment with sulfa drugs or arsenobenzol; after roentgen examination, operation should be performed at once, preferably by the technique of free thoracotomy. AUDREY G. MORGAN, M.D.

Dahl-Iversen, E., and Møller, P. E.: The Differential Diagnosis and Treatment of Tuberculomas in the Lung. *Acta chir. scand.*, 1946, 94: 243.

The problem is posed as the differential diagnosis of an isolated tuberculous process in the lung and a tumor, an infected cyst, and a chronic lung abscess. It is shown that the differentiation of these conditions, even under the most ideal conditions, is extremely difficult or impossible without exploratory thoracotomy. Three cases are presented in great detail to show the difficulties encountered. A fourth case was diagnosed as unilateral cavernous tuberculosis with roentgenographic changes suggestive of carcinoma. The suggestive findings in this case proved erroneous on exploration.

The pathological picture in these cases was that which is clinically termed tuberculoma and which pathoanatomically is called a conglomerate tubercle. The lesion occurs oftenest in the basal part of the cerebrum, in the cerebellum and the pons, and in the

spleen. The authors state that they have been unable to find a description of this lesion in the lung in the newer texts of pathological anatomy.

It is stated that tuberculomas of the lung should be removed and that the operation of choice, if the pleural cavity is free, is lobectomy because resection of the lung carries the risk of tuberculous infection of the pleura from the resected surface. This statement is not based on experience with regard to the course of nonoperated pulmonary tuberculomas, but on the fact that the course of tuberculoma in other sites is one of progression. One of the cases cited tends to show this.

The roentgenologist presents his view of the subject, and without the history, physical findings and laboratory data his task is next to impossible. Lung tumors may be polymorphous, and they can be confused with many other pulmonary conditions. The differential diagnosis from tuberculosis in its various forms often has to be considered and in many cases cannot be positively resolved by this method of investigation. In view of the authors' experience, thoracotomy has been necessary for definitive diagnosis.

EDWIN W. PASSARELLI, M.D.

HEART AND PERICARDIUM

Gilchrist, A. R.: Ligation of the Ductus Arteriosus. *Edinburgh, M. J.*, 1946, 53: 346.

Forty patients, ranging from 4 to 51 years of age, came under observation for a patent ductus arteriosus. The diagnosis was confirmed by operation in 19 of them. Four patients were found to have an infection superimposed upon the anatomical defect. Of these, 1 patient succumbed shortly after admission and 3 patients were operated upon. A brilliant result was obtained in 1 case, but a fatal outcome attended the other two interventions.

Thirty-six patients had no evidence of superimposed infection. Of these, 16 were operated upon, a second operation being done on 1 patient because of recanalization of the ligated ductus within 2 months. One patient was not benefited, 2 patients died, and the condition of 13 was materially improved.

The clinical and radiological features of the condition are described. The continuous, or "Gibson," murmur is almost certainly present by the age of 5 years even though it may be absent before that age. The accentuated pulsations of the pulmonary artery, the forceful contraction of the left ventricle at fluoroscopy, and the behavior of the blood pressure after exercise are elaborated upon.

Cases having evidence of an infection of the pulmonary artery or ductus are believed to constitute definite indications for surgical intervention. Evidence of such infection lies in the presence of septicemia, usually with cultures positive for streptococcus viridans and signs of pulmonary involvement such as multiple infarcts superimposed upon the signs of a patent ductus.

In the noninfected cases, ligation should probably be recommended if there is no evidence that the ductus is closing spontaneously in patients up to 10 years of age. After the age of 10, ligation is recommended if impairment of function is noticed, and after the age of 20 it is justifiable for threatened heart failure or grave symptoms.

Brief allusion to detail of the surgical procedure is made and illustrated case reports are appended.

HIRAM T. LANGSTON, M.D.

Mercer, W.: Patent Ductus Arteriosus and Its Surgical Treatment. *Edinburgh M. J.*, 1946, 53: 355.

The author describes in brief detail the surgical procedure employed. An anterior incision is used, usually entering the pleura in the second interspace. The phrenic, vagus, and recurrent laryngeal nerves are visualized and spared. The management of the ductus itself follows the techniques of Gross and Touroff. Dissection is kept preferably against the aorta. Overlapping of the ductus by the adjacent pulmonary artery or by an extension of the pericardium is occasionally noted.

The explanations for recanalization are reviewed and the technical steps designed to prevent this are pointed out. The author apparently uses two braided silk sutures or ligatures, but does not practice division of the ductus.

Attention is called to the changes in blood pressure which occur as a result of ligation, and the sometimes dramatic clearing of the blood stream of organisms in the infected cases is pointed out.

HIRAM T. LANGSTON, M.D.

ESOPHAGUS AND MEDIASTINUM

Welin, S.: A Contribution to the Roentgen Diagnosis of Limited Esophagitis. *Acta radiol.*, Stockh., 1946, 27: 461.

The occurrence of nonspecific inflammatory changes in the esophagus has long been recognized, but neither the pathological anatomy nor the roentgen details of the entity has received any extensive systematic investigation until recent times.

The postmortem examinations have revealed that the changes discovered occurred intra vitam. The possibility that gastric juices enter the esophagus after death and cause changes consistent with esophagomalacia acida had to be ruled out. Microscopic studies, however, clearly proved that the changes were inflammatory and that a definite esophagitis existed. Some maintain that even various stages—acute, subacute, and chronic—can be distinguished. The changes are confined for the most part to the lower esophagus. They may be consistent with an ulcerative esophagitis, but others think that they do not seem to fit into any of the usual classifications. The process is essentially an inflammatory one causing deep changes in the walls which eventually lead to a spasmlike stenosis. The appearance easily and frequently misleads to a diagnosis of cancer of the esophagus.

Welin reports 9 cases in patients ranging from 26 to 82 years of age. The dominant symptoms were a

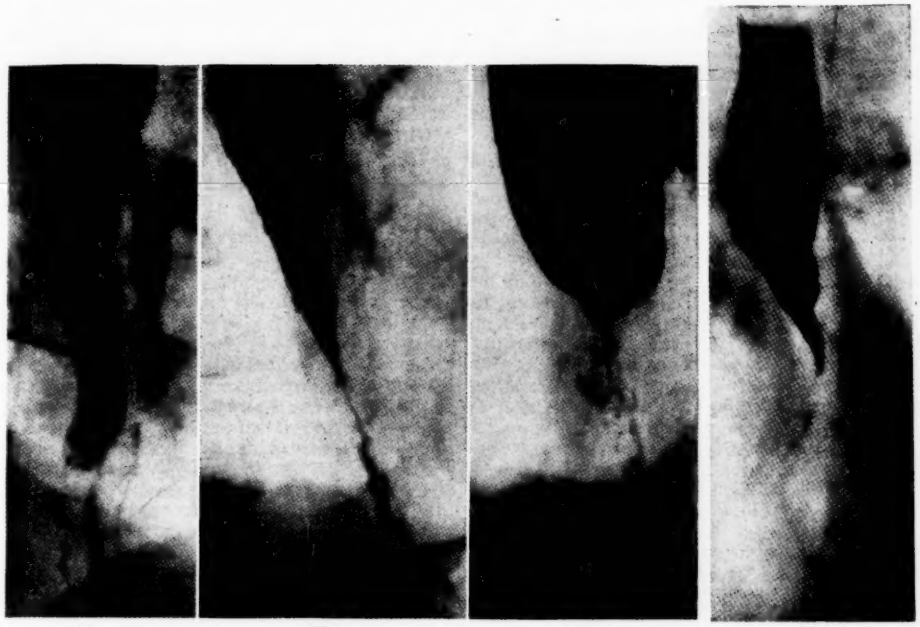


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Fig. 1. (Welin.) The initial stage of the disease, showing the coarse outline of the mucous membrane.

Fig. 2. The florid stage showing the typical changes; elongated funnel shaped constriction of the distal part, fairly distinct superior boundary, notched contour, and dilatation above.

Fig. 3. Two years and 3 months later. The patient has now reached the final stage. The stricture at this stage of the disease is more pronounced, and the "funnel" greatly shortened.

Fig. 4. Pronounced constriction and distinct limitation of florid stage.

progressive dysphagia, frequently at first merely a feeling of some obstruction behind the lower part of the sternum to the passage of solid food, but gradually this became worse until only finely divided or liquid food could pass through the esophagus; pain, described as a feeling of cramp behind the sternum, and hematemesis occurred later.

Three stages of the disease are recognized. The initial stage shows inflammatory changes limited to an edematous, slightly bulging, and easily bleeding mucous membrane. The florid exudative stage shows a normal or slightly reddened mucous membrane, and a narrowed lumen strongly inflamed and covered with fibrin. The upper limit of the constriction has a distinct, very sharp, and often lineal horizontal demarcation.

The clinical picture of esophagitis is such that clinicians will initially suspect a malignant process, but the roentgenological changes are characteristic in the more advanced cases of this disease. An elongated funnel shaped constriction with notched contours in the distal part of the esophagus, a relatively distinct superior boundary, and a cephalad dilatation of the process permit a diagnosis differentiating esophagitis from cancer.

Notwithstanding the benign histological nature of the process, the prognosis is very serious, and in a large number of cases gastrostomy will sooner or later be necessary. STEPHEN A. ZIEMAN, M.D.

Jacobsson, F.: A Patient with Cancer of the Esophagus, Alive and Free from Evidence of Tumor 6 Years after Roentgen Treatment. *Acta radiol.*, Stockh., 1946, 27: 351.

Treatment of cancer of the esophagus still yields poor results, and 5 year cures after roentgen treatment are rarely reported in the literature. The author reviews some 9 cases reported but notes that histological proof of the diagnosis was lacking in about half of the cases. He urges that every case of carcinoma of the esophagus surviving more than 5 years be described with details of treatment and sequelae in order to continue the improvement of the treatment.

The author reports the case of a patient treated for cancer of the esophagus who was alive and free

from tumor more than 6 years after the treatment. He was 58 years old when first seen in 1939. A diagnosis of carcinoma of the lower third of the esophagus was made with x-rays. Biopsy showed a squamous cell carcinoma with low differentiation. The chest roentgenogram and electrocardiogram were normal, and no evidence of metastases was found.

The patient was treated by the method of Strandqvist with crossfire radiation from three anterior and three posterior fields. The patient received 3,600 r. per field, except in the posterior central and the anterior lateral fields, each of which received 3,400 r. The treatment was given with about 175 kv. and an intensity of about 50 r. per minute, measured on the surface of the skin. As a filter ½ mm. of copper plus 1 mm. of aluminum was used. The size of the fields was about 6 by 13 cm. The tumor dosage was estimated at about 5,000 r. over 35 days.

The patient developed a blistering epidermatitis from the treatment but was clinically improved. Two months later the barium study of the esophagus was normal. Three months after the treatment the patient developed an induration in the right lung which cleared after 9 months. This was considered a radiation reaction.

The patient's heart began to enlarge 3 months after treatment but after a year the size remained stationary. After 5 years, the electrocardiogram showed signs of intraventricular conduction disturbances, a lesion presumably due to the treatment.

Three years after the treatment the patient developed a right pleural exudate which necessitated aspiration several times for the next 3 years. The exudate never showed tumor cells; therefore it seems likely that pleural metastases did not exist, and the exudate was probably due to the treatment.

More than 6 years after the treatment the patient was cured locally, had no difficulty in swallowing, and had no noticeable metastases. He had a slight hacking cough, became breathless, and had pain in the middle of his chest with exertion. These symptoms somewhat limit his capacity for work.

ROBERT R. BIGELOW, M.D.

MISCELLANEOUS

Scott, O. B., and Morton, D. R.: Primary Cystic Tumor of the Diaphragm. *Arch. Path.*, Chic., 1946, 41: 645.

The paucity of reports on primary diaphragmatic neoplasm indicates the rarity of this condition. In a recent review of this subject, the authors found reports of 32 benign and cancerous diaphragmatic tumors. Their series includes 4 cases; the diagnosis in these was not confirmed by operation or autopsy. It is anticipated that with the increased use of routine fluoroscopy and roentgenography of the chest, diaphragmatic tumors will be found with increased frequency. A report of this type of tumor is given in full.

The most constant symptom noted was pain in the chest, also in the hypochondrium and occasionally along the course of the regional intercostal nerves or toward the shoulders. Cough was a complaint occasionally and hemoptysis, once. Bulging intercostal masses as well as masses in the right and left upper quadrants of the abdomen have been noted. Dyspnea is sometimes present and pleural diffusion may occur. The diagnosis is finally made on roentgenographic evidence. Pneumoperitoneum may aid in outlining the position of the tumor.

EMIL C. ROBITSHEK, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Gurd, F. N.: Fundamentals of Technique in the Transverse Abdominal Incision. *Surgery*, 1946, 20: 217.

After a 30 year controversy as to the best type of laparotomy wound, both the vertical and transverse approaches have stood the test of time. The author gives a detailed description of the all-purpose transverse incision and answers some of the criticisms of the transverse technique.

When one or both rectus muscles are cut some filament of their nerve supply is probably sectioned. However, as this innervation is more plexiform than is generally imagined, and since one thoracic nerve can be sectioned without evidence of rectus paralysis, clinical evidence of weakness seldom follows this incision. If the laparotomy is performed so as to visualize these nerves, they can usually be spared. If 2 nerves are cut the rectus may bulge, and in the lower incision the functional integrity of the inguinal ring may be jeopardized.

If the muscle is cut across, healing occurs as readily as if the rectus is split. The excellent sheathing of both sides of the muscle holds the sutures better when it is cut transversely and mitigates retraction of the muscle. Such an incision leaves a functionally insignificant scar.

The larger transverse incisions may close more slowly, but evisceration is less likely with straining during closure than when the vertical incision is used. The expenditure of a few minutes of the surgeon's time is of no importance when considering the patient's welfare.

It has been claimed that the transverse incision does not give adequate exposure in the presence of a narrow costal angle. Adequate extension into the flanks will overcome this objection. The vertical incision is subjected to extreme strain and is difficult to close under these same circumstances.

The transverse incision should be thought of as a belt-line incision, being restricted to the band between the crest of the ilium and the costal cartilage. Otherwise the advantage of lateral extension into the flank is lost. The incision should be placed an inch above or below the umbilicus. Incorrect placing of the incision has resulted in the discouragement of many surgeons trying this approach.

The technique of the low right transverse incision such as is useful for work on the appendix, cecum, or ilium is described.

1. The line of incision is selected above the brim of the pelvis just below the umbilicus.

2. The skin is incised from beyond the midline to the right flank. The external oblique muscle at the lateral end of the wound should be well exposed.

3. In the same plane as the skin incision, the anterior rectus sheath is incised and extended laterally through the aponeurotic fibers of the external oblique muscle. When the muscular portion is reached the incision turns upward slightly to split the muscle.

4. The lateral edge of the exposed rectus is lifted and the eleventh thoracic nerve or a branch of it is visualized. The muscle is then freed from the posterior sheath for a distance of 1 or 2 inches above and below the plane of the incision and retracted medially. The lower edge of the external oblique muscle is retracted downward and laterally at the lateral edge of the wound.

5. The thin sheath of the internal oblique muscle is divided next, the incision beginning at the lateral edge of the rectus sheath and extending laterally and downward in the direction of the muscle fibers.

6. The posterior rectus sheath and peritoneum are opened at the lateral margin of the sheath and the incision is extended medially almost to the midline. Lateral extension of the incision is accomplished principally by hand, the internal oblique and transversalis muscles being split in the direction of their fibers. The twelfth thoracic and iliohypogastric nerves run beneath the internal oblique muscle. They should be identified and retracted laterally. The peritoneum is split laterally to the end of the wound.

7. The rectus muscles may be cut across if more exposure is necessary. The deep inferior epigastric artery and vein lying on the posterior surface of the rectus a little lateral to its center should be tied before the muscle is cut. If still more exposure is necessary, the same step by step procedure is carried out on the opposite side, and the patient is hyperextended. The upper abdominal incision is similar and is placed just above the umbilicus to clear the lowest portions of the thoracic cage. If the right rectus is sectioned, the falciform ligament also must be divided.

The closure must be carefully planned. The medial half of the incision is closed in two layers—one for the peritoneum and posterior rectus sheath, and one for the anterior rectus sheath. The lateral half is closed in three layers, namely, one for the peritoneum and transversalis muscle, one for the internal oblique muscle, and one for the external oblique muscle. It is well to jackknife the patient before closure is begun. Interrupted sutures are recommended, but if continuous sutures are used they should be locked when the outer margin of the recut sheath is reached. If this is not done, the relatively less rigid structures in this area may lead to puckering and cause the suture to loosen. The fat and skin are closed in any rational method. Subcutaneous retention sutures do no harm but have been largely abandoned. Deeply placed retention sutures are undesirable. A narrow transverse dressing with no abdominal binder is recommended.

This incision has several advantages: it can be readily extended—a 20 inch incision from flank to flank gives unrivaled exposure with a minimum of retraction, and postoperative complications are reduced. Costal respiration is less impeded by pain spasm than in a vertical wound. Effective coughing returns sooner. Early ambulation can be accomplished with less pain. It is believed that no fundamental principles are violated by this transverse incision, sited as it is in the line of the body's most important flexion crease.

ROBERT R. BIGELOW, M.D.

GASTROINTESTINAL TRACT

Kushlan, S. D.: Gastrointestinal Bleeding in Hereditary Hemorrhagic Telangiectasia; Historical Review and Case Report with Gastroscopic Findings and Rutin Therapy. *Gastroenterology*, 1946, 7: 199.

The author traces the history of hereditary hemorrhagic telangiectasia from the time it was separated from the large group of hemorrhagic diseases of uncertain origin by Osler. The condition is uncommon although it is not rare. It is inherited as a dominant characteristic. The sexes are equally affected and either sex may transmit it, although some generations may be skipped. Epistaxis, beginning in childhood, is often the first manifestation. Hemorrhage from the skin and oral mucous membranes is quite frequent. Gastrointestinal hemorrhages usually begin in the fourth decade. The criteria for diagnosis are: definite heredity, visible telangiectases with pathological distribution, and a tendency to bleed from the lesions.

The typical skin lesion is a sharply demarcated purplish red spot which may or may not be elevated. A single arterial vessel may connect with the spot, commonly called a "cherry angioma." When several branches are visible the lesion looks like an acquired vascular spider.

The basic pathology of these lesions is a thinning of the vessel walls, particularly of the muscular coat, which results in bulging of the wall in a defect which may be rather extensive. The lesions tend to be omnipresent in large numbers, both internally and externally, rather than in isolated groups.

The lesions are noted in the stomach and in the sigmoid colon.

Widespread bleeding from telangiectases in many different locations has been reported. It has also been reported that individual groups of dilated vessels are not permanent, but vary from time to time in number, size, and tendency to bleed. Except for lowered erythrocyte count and hemoglobin values, the blood findings are normal; however, the bleeding can result in a chronic anemia severe enough to be incapacitating and also a number of fatal hemorrhages have been reported.

Therapy has been difficult and unsatisfactory. The multitude of treatments advocated indicates the absence of any specific remedy. The only medication of proved value has been the administration of iron in full and continuous dosage to combat the anemia. A high protein diet is essential to help compensate for the chronic blood loss.

Transfusion becomes necessary in spite of the danger of reactions when the hemorrhage has been sufficiently severe or prolonged to lead to critically low red blood cell counts or to the danger of circulatory failure. Vitamin C had no effect on these patients. Because of the character of the lesion and the effect of vitamin P in similar situations in which other medications failed, rutin, which is like vitamin P in that it is a flavone glucoside, was administered, with excellent results. Rutin may represent a remedy for this condition, and certainly in view of its nontoxicity it should be tried in this and other allied situations. EDWIN W. PASSARELLI, M.D.

Homb, A.: On Acute Regional Enteritis. *Acta chir. scand.*, 1946, 94: 343.

The author segregates cases of regional enteritis into those in which the ileum is affected, and those in which the jejunum is affected. Inflammatory processes in the upper parts of the intestinal tract run a more acute course than those in the lower parts. As to etiology, it has been assumed that the inflammation is the result of infection by some microbe, but a specific bacterium has not been demonstrated. Since there is some question as to whether bacteria traverse an intact intestinal mucosa, it may be possible that irritations caused by foreign bodies such as fishbones and other gross material might initiate erosion on which inflammation can develop. The author cites a case of ulceration of the ileum by a fishbone, in which the pathological changes were identical with those encountered in acute regional ileitis.

The author's material includes 33 patients with acute ileitis and 8 with acute jejunitis. The symptoms in acute ileitis were for the most part identical with those of appendicitis. One third of the patients stated that they had had previous attacks similar to the present one. The average duration of the symptoms was 24 hours, but 3 of the patients had felt slight discomfort for a period of 2 weeks. In one-third of the patients the onset was sudden, while in two-thirds it was gradual. The initial symptom in most cases was pain, although no definite correlation was observed between the symptoms and the pathological findings.

Examination revealed right lower quadrant tenderness as a rather constant finding. Rigidity and tenderness on sudden release of pressure were demonstrated frequently. A palpable tumor in the right iliac fossa was found in only one patient. No parallel was found between the pathological findings and the temperature changes. Roentgenographic examination of the abdomen with a scout film was carried out in 11 patients. In 5 of these there were demonstrated the signs of peritoneal irritation; i.e., small fluid levels in the ileocecal region.

The indication for operation in almost every case was "suspected" acute appendicitis. The findings at

laparotomy showed exudate in the peritoneal cavity in 29 of the 33 cases. The changes in the ileum revealed injection of the serosa as a constant finding. Minor hemorrhages in the serosa were demonstrated in 8 cases, and a granulated or fibrin-coated surface was observed in 12. Most cases showed a thickening of the ileal wall with a rubberlike consistency. The lumen was constricted, but rarely to any great extent.

Interestingly enough, the author reports that although the appendix appeared normal in two-thirds of the cases, the operative treatment was as follows: appendectomy, 29 cases; exploratory laparotomy, 2 cases; walling off of the ileum with omentum, 1 case; and intestinal resection, 1 case. In the case of the last patient, it is believed that resection was unnecessary.

Postoperative follow-up studies indicate that aside from a troublesome diarrhea in some instances, all of the patients recovered. These striking results might indicate that resection in most cases of regional ileitis is an unnecessary procedure.

In discussing his 8 cases of acute jejunitis, the author points out that the symptoms are much more severe than in ileitis. The patients are more acutely ill and the pain occurs mostly in the epigastrium; the vomitus may be fetid and contain blood; diarrhea is a frequent symptom with occult blood or melena; leucocytosis and the sedimentation rate usually run higher than in appendicitis or ileitis.

Seven of the 8 patients were examined roentgenographically. Rather specific findings indicative of distended, gas-containing jejunal loops with very prominent plicae, were noted on the films. In the erect position the distended jejunal loops showed fluid levels.

Laparotomy was performed on 5 patients, with 2 deaths due to peritonitis. Resection was not done in any instance, but the involved loop of jejunum was simply covered with omentum. Three patients were not subjected to surgery and recovered under conservative management. From these observations it would appear that resection should have been performed in the cases which ended fatally.

HAROLD LAUFMAN, M.D.

Humphreys, G. H., II: An Approach to Resection of the Esophagus and Gastric Cardia. *Ann. Surg.*, 1946, 124: 288.

A considerable experience in dealing with tumors of the gastric cardia and the esophagus, and various older methods of dealing with these tumors are discussed. The cases of 75 patients treated at the Presbyterian Hospital, in New York, from January, 1941 to January, 1946 have been reviewed.

1. Esophagectomy with cervical esophagostomy and gastrostomy (the Torek procedure). This procedure, through a right-sided thoracotomy incision was carried out in 5 cases, with 80 per cent operative mortality, and no cure. It is now considered justified only in lesions involving the lower cervical esophagus.

2. Esophagectomy with esophagogastrostomy lateral to the aortic arch was carried out through a left-sided posterior thoracic incision in 5 cases, with 60 per cent operative mortality. One patient was well for a period of 2 years.

3. Esophagectomy with esophagogastrostomy below the aortic arch. In 9 cases this procedure was carried out through posterior thoracic incisions, and in 2 cases through an anterolateral combined abdominothoracic incision, with a 45 per cent operative mortality. Two patients are well after a period of 8 and 6 months.

4. Esophagogastrectomy with intrathoracic esophagogastrostomy or esophagojejunostomy. In 2 cases operation was carried out through a posterior thoracic incision, and in 10 cases through an anterolateral combined abdominothoracic incision. The operative mortality in this group was 50 per cent. Three patients are well after a period of from 5 to 15 months.

5. Partial or complete gastrectomy with intra-abdominal esophagogastrostomy, esophagojejunostomy or gastrorrhaphy. In 3 cases the operation was carried out through a combined abdominothoracic incision, and in 2, through the abdominal portion only. There was no operative mortality. Two patients are well 2 and 2.5 years after operation.

6. Palliative gastrostomy. In 19 patients operation was carried out without exploration, in 11, after determination of inoperability by thoracotomy, and in 7 after determination of inoperability by the abdominal portion of a combined incision. The operative mortality in this group of 37 cases was 8 per cent, the longest survival 20 months.

RICHARD J. BENNETT, JR., M.D.

Walters, W.: Resection of Stomach. *J. Am. M. Ass.*, 1946, 131: 1269.

In 3 of 5 cases in which hemorrhagic and ulcerative gastrojejunitis occurred after gastroenterostomy was performed for congenital pyloric stenosis, removal of the gastroenteric anastomosis, resection of the stomach, and the Billroth I (von Haberer) type of anastomosis between the proximal end of the stomach and the duodenum produced relief. In 2 cases, hemorrhages occurred 6 and 9 years respectively after this procedure. In 1 case it followed overindulgence in food and in stimulants and gastric irritants. No further bleeding has occurred since the patient began to abstain from use of alcoholic beverages. Both patients were well when last heard from.

Two of the patients had undergone pylorectomy after bleeding occurred without relief. Bleeding ceased after the gastroenteric anastomosis was taken down and partial gastrectomy was performed.

In 2 cases, severe gastrointestinal hemorrhages apparently occurred in the presence of a relative achlorhydria.

In 1 case a gastrojejunal ulcer perforated 7 weeks following a thorough examination in which the patient was found to have a relative achlorhydria, and

findings on roentgenological examination indicated that the gastroenteric stoma was functioning normally.

In only 1 case was a definite jejunal ulcer demonstrated by roentgenological examination. In this case the patient had had definite symptoms of ulcer previously, but these had responded to the medical regimen.

In the case of a naval officer operated on at the United States Naval Hospital, Philadelphia, the roentgenogram seemed to show a malfunctioning gastroenteric stoma with dilatation of the proximal loop of jejunum. At operation this dilatation was not found. Excellent results have followed removal of the gastroenteric stoma, closure of the opening in the jejunum, and partial gastrectomy with Billroth I (von Haberer) anastomosis.

Gainsborough, H., and Slater, E.: A Study of Peptic Ulcer. *Brit. M. J.*, 1946, 2: 253.

A study of peptic ulcer in 130 men and 32 women was made, with particular emphasis on a psychiatric examination and follow-up study for a period of 3 years.

The type of ulcer (duodenal or gastric) and the sex incidence are discussed. The age distribution was similar to that found in other studies. Whereas 12 single, 115 married, and 3 widowed men were included in the group, the female group yielded figures of 17, 10 and 5 for the similar classifications. The effect of financial stress was believed to be slight in the males, but marked in the females. An analysis of gastric disease and indigestion in parents and siblings suggested that a hereditary constitutional factor might be present.

The male patients showed a preponderant tendency to correspond to the obsessional personality type. Their energetic dispositions and their tendencies to anxiety, irritability, obsessionality, and hypochondriasis was noted. The women showed a higher incidence of constitutional instability than the men. Actual neurosis was uncommon. Psychogenic causes of worry were found in 10 males and 12 females.

The results of treatment were reported as showing relapses in one third of the patients in the first 4 months. None of the psychiatric findings were helpful in prognosis. Previously, heavy smokers showed a lower rate of relapse, presumably due to reduction of smoking during treatment.

The authors believe that more attention during the follow-up period should be paid to adjustment of work conditions, and careful discussion with the patient of his social and psychological problem.

THOMAS C. DOUGLASS, M.D.

Houston, W.: Aftermath of Perforated Peptic Ulcer. *Brit. M. J.*, 1946, 2: 221.

The author studied the results of simple suture of perforated peptic ulcer in 538 cases in which the operation had been performed 12 or more years previously. Only 244 answers were received to the 538 questionnaires sent out. One hundred and seventy patients reported for examination, and reports of 33 deaths in the interim were received.

In this hospital the ratio of males to females was 15 to 1. Duodenal ulcers were seen more frequently than gastric ulcers by 8 to 1. A marked decrease in the mortality rate in 1943 and 1944 was attributed to the use of sulfonamides.

Of the small group of patients who answered the questionnaire, 35 per cent had had no further symptoms. The number of patients with gastric ulcer who reported for examination was small (7), but of these, 6 had had recurrent symptoms.

One hundred and sixty-one patients with ruptured duodenal ulcer were examined. Of these, 38 per cent had had no further symptoms. A third of those having further symptoms had required subsequent surgery. The chances of cure were better in the group in which perforation was the first symptom. In this small group, the rate of cure seemed higher in the older age groups (45 or over). The effect of postoperative home dieting on the recurrence rate was apparently negligible.

Recurrence of symptoms was usually noted in 2 years, the longest interval being 5 years, after which symptoms recurred. When divided into two groups having symptoms for a period of 1 year or less, and for more than 1 year, there was no significant difference in the recurrence rate.

THOMAS C. DOUGLASS, M.D.

Waugh, J. M., and Clagett, O. T.: Resection of the Duodenum and Head of the Pancreas for Carcinoma. *Surgery*, 1946, 20: 224.

In 30 cases, resection of the head of the pancreas and duodenum was performed for carcinoma in this region, with an operative mortality of 20 per cent. The postoperative survival thus far on a short follow-up study is disappointing in the cases in which the operation was done for carcinoma of the head of the pancreas, but encouraging in those in which it was done for carcinoma of the ampulla of Vater.

Although the one-stage procedure is usually preferable, there is the occasional patient with severe damage to the liver, who will require a two-stage operation. Pancreaticojejunostomy, either end-to-end or end-to-side, has definitely improved the prospect for normal nutrition postoperatively. Choledochojejunostomy usually is preferable to cholecystojejunostomy in the one-stage procedure. Postcolic, antiperistaltic gastrojejunostomy, made distal to the biliary and pancreatic anastomoses, lends itself well to this type of resection and has proved most effective in the past in the authors' hands.

Therkelsen, F.: On the Histological Diagnosis of Appendicitis. *Acta chir. scand.*, 1946, 94: Supp. 108.

The author believes that obstruction with enterogenous infection is the main cause of acute appendicitis. In a small number of cases, lymphoid hyperplasia has been found to cause symptoms resembling appendicitis, possibly because of the stenotic effect

of the swollen lymphoid tissue. Fecal particles may produce an ulceration of the mucous membrane without simultaneous obstruction, and thus permit the entrance of bacteria. The noninfected ulceration may give rise to a so-called appendicosis appearing mainly in the form of a recurring or chronic appendicitis. Acute segmental appendicitis has been produced by ligation of the vessels of the organ. Therefore, embolic or thrombotic lesions of the vessels with resulting necrosis and infection, due to the presence of bacteria in the lumen, may occasionally explain the sudden onset of appendicitis. In some cases trauma has been found to be the cause. The bacteria causing appendicitis are mainly Bacillus coli, though enterococci and nonhemolytic streptococci do occur.

The author believes that it is easy to make the histological diagnosis of acute appendicitis in severe cases, but in mild cases the differentiation between a normal and a pathological condition is difficult. The initial stage of acute appendicitis is a primary infection, evidenced by the accumulation of neutrophilic leucocytes about a small defect in the epithelium, at the bottom of a crypt. The epithelial defect is covered by a plug of leucocytes and fibrin. From this site, the inflammatory process spreads to the walls of the appendix, and takes on the shape of a wedge, with its base peripherally, so that the leucocytes occur in largest numbers in the subserous portion. Various changes take place in the nerve apparatus of the appendix, but no relationship has been established between the various changes and the different types of appendicitis.

In an attempt to establish a surer basis for the histological diagnosis of acute appendicitis, the author examined 100 appendices (obtained at autopsies) of patients who died from unrelated conditions, and 199 appendices of patients who were operated upon for acute appendicitis.

A study of the normal material revealed the following:

1. In addition to eosinophils and plasma cells, densely packed clusters of lymphocytes occur normally in the lymph spaces of the muscularis and subserosa.

2. Extravascular neutrophils must always be considered pathological.

3. A more or less marked fibrosis of the appendix was found in 64 per cent of the normal cases. In 25 per cent of these cases, there was present a partial or complete obliteration.

4. An appendix is termed grossly normal when its surface is not particularly injected, when it is not covered with fibrinous or purulent coatings, and which, when opened, exhibits a light yellowish mucosa, which is only slightly granular, but may be the site of extensive ecchymoses. Questionable acute inflammatory changes are the thickening of the wall, combined with some hyperemia of the surface, and a red hyperemic mucosa which may be more or less swollen. Definite acute inflammatory changes are a distinctly congested and edematous wall, with purulent or fibrinous coating on the surface. The lumen may be filled with pus. The mucosa is the site of necroses and ulcerations.

A study of the diseased material revealed:

1. Of 154 cases histologically proven to be acute appendicitis, only 125 revealed simultaneous gross evidence of acute inflammation. Four cases were grossly normal.

2. Two cases showed an accumulation of neutrophils in the form of small foci in the mucosa. This type is described as a localized acute appendicitis.

3. One hundred and fifty-two appendices exhibited inflammatory changes extending throughout the entire organ. This type is called diffuse acute appendicitis.

4. A fibrosis of the appendix was demonstrated in 124 cases.

It is extremely difficult to make a histological diagnosis of chronic appendicitis.

SAMUEL KAHN, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Kaijser, R.: Concerning Cholangiography in Compression or Stricture of the Distal Portion of the Common Bile Duct, with Remarks upon the Diagnosis and Therapy of Carcinoma of the Ampulla of Vater (Über das Cholangiographiebild bei Kompression oder Striktur des distalen Choledochusabschnittes Nebst einigen Bemerkungen über Diagnose und Therapie bei Carcinoma papillae Vateri). *Acta med. scand.*, 1946, Supp. 170, p. 463.

The author divides his article into two parts, one concerning the cholangiographic picture in a wide variety of lesions of the common bile duct, and the other being a more or less complete review of the subject of carcinoma of the ampulla of Vater, including a report of 2 cases. The former part is the more interesting as it is based on an extensive experience with cholangiograms taken on the operating table in a large variety of mechanical obstructions, both intrinsic and extrinsic. In several of the films the author was able to demonstrate calculi within the duct while other types of mechanical obstruction were present simultaneously. In 1 such film there were 2 stones within the duct, and between them there was a constriction which was believed to represent an organic stricture caused by malignancy of the duct. In other cases there was obstruction caused by enlarged lymph glands which impinged upon the duct and narrowed its lumen. The author demonstrated a film which he believes is typical for the type of obstruction caused by fibrosis and stricture in the duct, and another which is typical for the obstruction caused by carcinoma of the head of the pancreas.

In the second portion of the article the incidence, symptomatology, diagnosis, and therapy are discussed. The author is in agreement with the general literature except in regard to the reported incidence in the sexes, believing that the lesion is more frequent in the female; this is in contrast to Brunschwig's findings. The author believes that in the

clinical study there is not very much to guide one in differentiating icterus of carcinoma of the ampulla of Vater from the other more common forms of icterus. The various liver function tests may be of help in differentiation of the intrahepatic causes of jaundice. There is little, however, even at the operating table, which will differentiate the ampullary neoplasm from either stricture or stone. The finding of occult blood in the stool and the roentgen study of the duodenum may be suggestive but is far from conclusive. At the operating table, palpation may be of help but it is fraught with uncertainty. The probing of the duct may also be inconclusive. On the other hand, the author believes that the cholangiogram is typical. The shape of the curve of the contrast medium at the lower end of the duct is not blunt as it is in stricture, nor does it show a convexity upward as in the presence of a calculus, but rather displays a definite filling defect with an irregular passage.

Two cases of carcinoma of the ampulla of Vater are detailed as well as 1 of icterus secondary to hyperplastic swelling of the glands of the hepatoduodenal ligament.

WILLIAM C. BECK, M.D.

Mallet-Guy, P., JeanJean, R., and Ronchet, J.: The Prevention of Hemorrhagic Complications in Biliary Surgery by Vitamin K (La prévention des complications hémorragiques en chirurgie biliaire par la vitamine K). *Lyon chir.*, 1946, 41: 160.

The authors have reviewed the records of 225 patients who were subjected to surgery of the biliary tract and have made the following observations concerning the relationship of the prothrombin time and hemorrhagic tendencies.

Before operation, if the prothrombin time is less than 65 per cent of normal, there is risk of spontaneous hemorrhage. During operation, if the prothrombin time is less than 72 per cent, there is danger of difficulty in obtaining hemostasis. After operation, if the prothrombin time is less than 80 per cent, there is danger of hematoma formation or of hemorrhagic complications.

The 225 patients were divided into three groups.

Group 1 (63 patients) had prothrombin times higher than the minimum normal. They had no preoperative vitamin K and no postoperative bleeding.

Group 2 (126 patients) had prothrombin times which were definitely subnormal. They received vitamin K therapy until the prothrombin time returned to normal and there were no instances of postoperative hemorrhage.

Group 3 (36 patients) had prothrombin times at the lower limits of normal. They would seem to need no vitamin K, but in 3 cases a postoperative hematoma occurred. This may be due to a disturbance of the prothrombin time caused by the operative procedure. The authors believe that this group should receive preoperative vitamin K therapy, and that it should be continued for several days after operation.

Thus, 162 patients (a large majority of the group) had an actual or potential hemorrhagic tendency and required vitamin K therapy.

Chronic icterus was present in 87 cases. Forty-four of these patients had neoplastic obstruction, and they had particularly low prothrombin times. However, no hemorrhagic complications occurred in this group because all had received adequate vitamin K. The remainder of the patients with jaundice due to cirrhosis, hepatitis, calculus, adenopathy, chronic pancreatitis, or disturbances of the sphincter of Oddi, did not manifest severe disturbances of prothrombin time.

In conclusion, the authors propose the following three types of treatment according to the prothrombin level:

1. An aggressive treatment when the deficit in prothrombin time is at an alarming figure (20 per cent of normal or less), or when emergency surgery is necessary. Eighty drops of K-thrombyl solution in 24 hours with an injection of 10 mgm. of vitamin K for 2 or 3 days generally produces the desired effect.

2. A more leisurely treatment when the prothrombin time oscillates in the neighborhood of 75 per cent. This can be accomplished by giving 60 drops for 4 to 6 days. If there is an associated icterus, one gram of bile extract should be given with every 60 drops.

3. A maintenance treatment of 40 to 60 drops in 24 hours assures continuation of the vitamin K effect during the postoperative period.

EDWARD W. GIBBS, M.D.

Söderlund, G.: A Contribution to the Casuistics of Inflammatory Pancreatic Cysts. *Acta med. scand.*, 1946, Supp. 170, p. 685.

The author reviews 5 cases of pancreatic cysts arising in connection with acute or subacute pancreatitis. All were inflammatory pseudocysts which were treated in one of two ways:

1. Marsupialization, or opening of the cyst and sewing the cyst lining to the anterior abdominal wall. With drainage thus established, shrinkage of the cystic cavity and obliteration were obtained. This method of treatment was employed in 3 of the 5 patients.

2. Gastric anastomosis. In the remaining 2 patients, the cyst lay behind the stomach, firmly adherent to the posterior abdominal wall. Anastomosis of the cyst to the stomach was accomplished in these patients. The stomach was opened and an incision was made through the posterior wall directly into the cyst. The cyst lining was sutured to the stomach with closure of the anterior gastric opening to form a closed anterior drainage of the cystic contents with subsequent shrinkage and obliteration. A Wetzel tube, where needed, was employed in the anterior opening of the stomach, to establish an external drainage of the contents which may be evacuated into the stomach.

The present article includes a detailed case history with daily progress notes of each patient as (apparently) recorded on the original hospital chart.

STEPHEN A. ZIEMAN, M.D.

Dameshek, W., and Grassi, M. H.: Infectious Lymphadenosis ("Mononucleosis") and Thrombocytopenic Purpura; Recovery after Splenectomy. *Blood, J. Hemat.*, 1946, 1: 339.

Among the features of infectious lymphadenosis ("mononucleosis") which help to distinguish it from acute lymphatic leucemia is the lack of reduction in red blood cells and platelets. Conversely, the association of a well defined anemia and/or thrombocytopenia, with a marked degree of lymphocytosis in which abnormal lymphocytes are conspicuous, almost certainly indicates acute leucemia. The present case is an exception to this rule.

The patient was a young woman with a severe purpura hemorrhagica, a generalized lymphadenophathy, and a lymphocytosis. The clinical picture suggested an acute lymphatic leucemia but the lymphocytes suggested infectious mononucleosis, which was confirmed by a strongly positive heterophile agglutination. When the bleeding became uncontrollable splenectomy was performed, followed by prompt recovery. The splenic histology was characteristic of infectious mononucleosis.

This case is of interest not only because of its rarity, but because it brings up anew the diagnotic feature of infectious mononucleosis, the question of "hypersplenism" and its relationship to thrombocytopenia, and the lymphocytosis observed in a number of cases of idiopathic thrombocytopenic purpura. SAMUEL J. FOGELSON, M.D.

Smith, E. B., and Custer, R. P.: Rupture of the Spleen in Infectious Mononucleosis. *Blood, J. Hemat.*, 1946, 1: 317.

Infectious mononucleosis has been regarded as a benign disease until very recently. Rupture of the spleen as a fatal complication has received little attention, there being only 3 well established cases in the literature. This report adds 7 additional cases in which splenic rupture occurred. All of these patients were subjected to splenectomy, but only 3 recovered.

A characteristic histological picture was found in all of the patients. The splenic capsule was found to have virtually lost its identity. It was infiltrated with lymphocytes and large mononuclear cells. The capsule and the immediate subjacent pulp was edematous. The splenic trabeculae were infiltrated by mononuclear cells to an even greater degree than the capsule, frequently having undergone dissolution. The splenic pulp was increased in bulk and its architectural pattern was blurred, principally because of the excessively cellular cords of Billroth which compressed the sinuses and rendered them relatively bloodless. The predominant mononuclear cells varied from 12 to 15 microns and were round except when distorted by pressure; the cytoplasm was homogeneous and faintly acidophilic. The centrally or eccentrically placed nucleus was sharply delineated by a thin membrane and chromatin was irregularly distributed to lend a mottled appearance.

The blood vessels of the spleen also showed a consistently striking histological change. The small arteries were ensheathed by normal and abnormal lymphocytes which completely separated them from the surrounding trabeculae. These vascular lesions are similar to those frequently found in leucemia, scarlet fever, occasionally in chronic malaria, and acute fulminating infections.

It is obvious from these histological descriptions that the basic structure of the spleen is weakened in infectious mononucleosis, and it is surprising that it does not rupture more often.

SAMUEL J. FOGELSON, M.D.

Benhamou, E., and Laffargue, P.: Sarcomas of the Spleen (Les sarcomes de la rate). *Presse méd.*, 1946, 54: 485.

Statistics have always reported sarcoma of the spleen as being very rare, but the authors have seen 9 cases in the past 6 years in Algiers, which leads them to doubt its extreme rarity. Sarcoma of the spleen should be suspected if the spleen is enlarged without accompanying enlarged glands in subjects from 25 to 55 years of age, if the organ is hard and painful, if there is rapid emaciation, persistent asthenia, and irregular temperature. The diagnosis can be confirmed by the test of contraction of the spleen following the use of adrenalin and by histological examination of a smear from the spleen.

In the authors' cases there was hyperleucocytosis up to 16,000 with the proportion of the different forms of leucocytes practically normal. This served as a differential point from Banti's disease in which there is leucopenia with a tendency toward mononucleosis, from Hodgkin's disease in which the leucocytosis is predominantly eosinophilic, and from tuberculosis of the spleen in which there is sometimes an increase of the red cells.

In 5 of the authors' cases there was necrosis of the spleen with cavities resembling those of tuberculosis, while in 2 other cases there was no macroscopic necrosis but necrosis was shown on microscopic examination.

Details are given in 1 case of a man of 27 who recovered after splenectomy and blood transfusion. The authors think that treatment is hopeful in these cases if the diagnosis is made early before the glands become enlarged and before the patient's general condition becomes too serious. Treatment consists of splenectomy, blood transfusion, and deep roentgen therapy. AUDREY G. MORGAN, M.D.

MISCELLANEOUS

Meyer, H. W.: Acute Superior Mesenteric Artery Thrombosis; Recovery following Extensive Resection of the Small and Large Intestines. *Arch. Surg.*, 1946, 53: 298.

The author describes a case of acute superior mesenteric artery thrombosis, treated by very wide resection and resulting in a good recovery. A 19 year old infantryman was recovering from minor shell fragment wounds of his left arm and right thigh in an evacuation hospital when, on the third evening

after admission, he developed symptoms of an acute surgical emergency. Subsequent history revealed that since 11 or 12 years of age he had been having attacks of cramplike pain several times a week to every few months which lasted a maximum of several hours. A similar attack started the day the patient was wounded but he did not mention it until the pain became unbearable. The severity of the pain was out of all proportion to the mild bilateral rectus spasm and midabdominal tenderness. The white blood count which was 17,000 at the onset of the severe attack reached 22,300 with 17 per cent stab forms and 72 per cent polymorphonuclear leucocytes by the following morning when the necessity for surgical exploration was established. At this time the patient's temperature was 100.2°F. and his pulse rate 120.

At operation there was a pronounced odor of gangrene when the abdomen was opened and the presenting intestines were blue-black but not distended. Gangrene extended from 20 inches distal to the proximal end of the jejunum to the midtransverse colon, and when resected the thrombi were seen in the great vessels in the root of the mesentery. All of the gangrenous bowel was resected and an isoperistaltic side-to-side jejunocolostomy to the left half of the transverse colon performed. This left the proximal 18 inches of the jejunum, the left half of the colon, and a nutritional problem seemingly without precedent.

Immediate postoperative care was essentially that of any other major abdominal procedure and surgical recovery was uneventful except for a right popliteal occlusion by a clot on the fifteenth postoperative day, which was removed surgically without difficulty.

When oral feedings were started liquid stool was passed almost constantly, which slowed to about 6 to 7 soft stools daily in several weeks. The urinary output was as low as between 500 and 600 c.c. daily as a result but it returned to normal in time. The stools improved until, 9 months later, he had 2 to 3 soft-formed stools daily. At this time the patient's weight was 120 pounds as contrasted with 138 pounds just before he was wounded. Throughout the postoperative period the patient's chemistry was maintained very close to normal limits. Mention is made of high vitamin and protein intake in the immediate postoperative course but no mention is made of the intravenous and oral chloride requirements.

On all diets late in his course, large amounts of fat and starch were present in the stool, but it was determined largely by trial and error that he did best on a high carbohydrate, low fat, and medium protein intake. FREDERICK C. HOEBEL, M.D.

GYNECOLOGY

UTERUS

Dalgaard, J. B.: The Blood Vessels of the Human Endometrium. *Acta obst. gyn. scand.*, 1946, 26: 342.

The literature on the subject of the blood vessels of the human endometrium is reviewed and a new classification of the menstrual cycle is presented.

The material consists of 16 specimens of post-mortem examined human uteri. The technique of injection is discussed. India ink was injected, arterially or venously, in some of the specimens; in others the Sjostrand method of blood corpuscle coloration was used.

A minute description of the histological findings in every specimen is given and the material is grouped according to menstrual phases with subheadings for cervical and atrophic endometrium.

The endometrial vessels are branches and continuations of the myometrial vessels. The endometrial arteries of monkey and man are of two types: endometrial spiral arteries and endometrial basal arteries. The former arises as a continuation of the myometrial radial artery, while the latter sometimes appears as a branch of the myometrial radial artery, sometimes as a special vessel from the myometrium. The endometrial basal arteries supply the basal part of the endometrium, run obliquely or nearly parallel to the surface in the boundary zone, but to a lesser degree in the basalis.

The endometrial spiral arteries are continuations of the myometrial radial arteries. The coils of these vessels are lowest, broadest, and present the most numerous coils per height unit in the basilar area. The author found that the endometrial spiral arteries already in the proliferative phase reach the surface; very few branches are given off. The diameters of the vessels diminish very little throughout the endometrium. They have a distinct elastic membrane. They continue directly into the venous lacunae, through arteriovenous anastomoses. The lacunae are the superficial parallel network of vessels, most often seen in the phases of proliferation and early secretion. The venous plexus is interposed between the lacunae and the ordinary capillaries on one side, and between the lacunae and the collecting veins on the other side.

An attempt is made to explain the anatomical findings with relation to the menstrual function.

T. Floyd Bell, M.D.

Ritala, A. M.: On the Methods of Treatment in the Presence of Pyometra. *Acta obst. gyn. scand.*, 1946, 26: 225.

The author states that in Finland the majority of patients suffering from cervical carcinoma seek medical advice when suppuration has developed and the diagnosis can be made by the typical pungent odor alone. He makes a plea for earlier diagnosis, before infection has become active, even though he is aware that in his country patients wait for long periods before they are admitted to the hospital.

The author gives a survey of the pathogenesis and prophylaxis of pyometra. Infection of the uterus, especially in cases of carcinoma, is looked upon as a local disease and even as a point of entrance for numerous inflammatory processes tending to spread throughout the body.

The possibility of using modern local antibiotics is discussed. In this connection several new instruments devised for the drainage of pyometra are described. They consist mainly of a set of graduated dilators with multiple openings. Other instruments which permit the use of wet and dry intrauterine medicaments to be introduced without increasing the intrauterine pressure are illustrated by photographs and drawings.

Harry W. Fink, M.D.

Danforth, W. C.: Total Abdominal Hysterectomy. A Study of 500 Cases. *Am. J. Obst.*, 1946, 52: 218.

In those cases in which it is preferable to perform hysterectomy by the abdominal route, total excision of the uterus is being done with greater frequency in many of the more active clinics of the country. The author believes that removal of the cervix has definite advantages whether it is accomplished by the abdominal or the vaginal route. Although the reported incidence of cancer of the cervical stump is small, it is worthy of notice. A second reason for total excision is that many of the cervices are diseased. These cervices which are not entirely normal are often troublesome after a subtotal operation. Therefore, elimination of the cervix seems desirable provided that it can be done without increasing the mortality or morbidity rate, or, in any event, an increase not greater than the number of cases of stump cancer would account for.

Danforth reports a series of 300 total abdominal hysterectomies performed by a group of trained gynecologists, all of whom are members of the Department of Obstetrics and Gynecology of Northwestern University, Chicago. The following conditions were considered essential indications for hysterectomy: myoma, cancer of the corpus, adenomyosis, and inflammatory residues. A badly diseased cervix was noted in 70 cases.

There were 2 deaths, a mortality rate of 0.4 per cent. The death of one patient resulted from septicemia; the second patient died of uremia with failure of urinary secretion, even though cystoscopy and ureteral catheterization proved the absence of ureteral obstruction.

Morbidity was estimated according to the standard of a rise of temperature to 100.4 degrees F. on any of two days, excluding the first 24 hours. Using this rigid standard, 141 patients (28.2 per cent), had

a morbid recovery. Serious morbidity occurred only rarely. Thrombophlebitis occurred in 3 cases; all 3 patients recovered. Ureteral injury occurred in two instances and nephrectomy was necessary in both cases. In 4 cases the bladder was opened. Immediate suture plus the use of a permanent catheter yielded a smooth recovery.

The adnexa were treated conservatively unless gross disease was present. The author prefers to leave the appendix alone.

The simple technique is well described and amply illustrated. Fine chromic catgut is used and closure is accomplished without drainage. The author believes that in trained hands, total abdominal hysterectomy may be used frequently or even almost routinely. EDWARD L. CORNELL, M.D.

Heyman, J., and Benner, S.: Further Experience with Radiotherapy in Cancer of the Corpus of the Uterus. *Acta radiol.*, Stockh., 1946, 27: 328.

The 5 year results in cases of cancer of the corpus of the uterus treated from 1934 to 1939 by the Radiumhemmet method of packing the uterine cavity with radium tubes is reported. The survey of the results is preceded by a brief summary of the system of classification, examination, and treatment.

Prior to 1930, cases of corpus cancer were treated by introducing into the uterine cavity a single tube containing between 35 and 45 mgm. of radium element. The patient was irradiated twice with an interval of 3 weeks between the first and the second treatment. Each time about 1,200 mgm. of element hours were administered. Because of the unsatisfactory results obtained by using a single narrow and powerful tube, the packing method was gradually elaborated between 1930 and 1934, and now the uterus is packed with less powerful tubes of equal size and shape and in sufficient numbers to get the uterine cavity completely filled.

Primary radiological treatment, combined with surgery in case of failure, is the routine method of treatment. Primary surgical interference is resorted to in occasional operable cases, for instance, cases of corpus cancer combined with large fibroids or with an ovarian tumor. In each case, radium is applied twice, with an interval of 3 weeks between the applications. The time during which the radium remains in the uterus varies with the number of irradiators applied and the size of the additional filter chosen. The treatment time is given in a table at the end of the original article.

During the period from 1914 to 1939, inclusive, 698 patients suffering from cancer of the corpus were seen. In 28 cases, treatment was considered unsuitable. A 5 year cure rate of 64.9 per cent was obtained by the packing method in a series of 316 patients, as compared with 45 per cent in 354 patients treated with a single tube. The authors believe that it is possible to obtain better results by radiotherapy alone than by surgery alone. Following the use of the packing method, 22 patients were operated upon after failure of radiotherapy.

Conclusions as to the value of primary hysterectomy plus postoperative irradiation, compared with that of primary radiotherapy plus hysterectomy in case of failure of the former, should be postponed until significant statements concerning the results of the first mentioned method are available.

GEORGE BLINICK, M.D.

Kahanpää, V.: Carcinoma of the Cervix Uteri in Young Women. *Acta obst. gyn. scand.*, 1946, 26: 379.

The author's material consists of 28 cases of carcinoma of the cervix uteri in patients under 30 years of age, the youngest being 21 years. The statement that carcinoma of the cervix is being transferred to younger age groups has not been proved and seems improbable. The lack of pregnancy in the previous history does not exclude the possibility of the disease in a young woman.

The possibility that carcinoma of the cervix in general is especially malignant in young women does not seem likely, as judged from the results of treatment. The author recommends local examination of young women, which will avoid treatment at a late stage with its bad prognosis. The possibility of carcinoma in a young woman should always be considered in the event of irregular bleeding, and no kind of treatment suggested until examination has ruled out cancer. T. FLOYD BELL, M.D.

Ritala, A. M.: Clinical Investigation of a Complication Fistula Rectovaginalis after Radium Therapy of Cervical Carcinoma. *Acta obst. gyn. scand.*, 1946, 26: 193.

During the past 20 years at the Womens Clinic of the University of Helsinki, almost 2,000 patients have been treated with radium for cancer of the cervix. This was done by the so-called Stockholm method in which the cervical or intrauterine dose is generally 2,400 mgm. hr. and 4,500 mgm. hr. vaginally. Most of the patients, unfortunately, do not present themselves for treatment until they are in group III or IV. There were 231 cases of grades I and II which received radium treatment. Only these cases were used as suitable material for investigation of the occurrence of vesicovaginal and rectovaginal fistulas following radium treatment since in cases of grades III and IV the malignancy itself may have affected the surrounding tissues to the point of perforation.

In nearly one-half of the patients treated by radium in the usual way there developed symptoms of irritation, tenesmus, ulceration accompanied by hemorrhages, and frequently also stenosis in the rectum, caused by induration. There were 8 cases of rectovaginal fistula. During the first 10 year period there were none and then 5 developed in 1 year.

The rectovaginal fistulas appeared from 6 to 13 months after the irradiation. The perforation of the rectovaginal septum caused a long period of suffering and when it occurred in the rectum higher up led to general peritonitis and a hasty end.

Since the avoidance of injury to the rectum and the bladder is the central feature in radium treatment in gynecology, the author discusses the problem of the advisability of increasing the present vaginal dose of between 4,500 and 5,000 mgm. hr. in order to obtain better end-results in the treatment of cancer and at the same time diminish the danger of injury to neighboring organs, especially the rectum. He has come to the conclusion that this is possible. HARRY W. FINK, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Bohm, E., and Englund, S.: Results of Salpingostomy at the Public Maternity Hospital, Stockholm, 1931–1942. *Acta obst. gyn. scand.*, 1946, 26: 329.

Martin, in 1885, was the first to carry out a salpingostomy. Since then many reports have been given with varying results. The author reviews these reports. American gynecologists were mainly opposed to the operation, because of the bad results obtained. According to the more comprehensive collection of material cited, from 7 to 10 per cent of the cases operated upon resulted in pregnancy, and the number of parturition pregnancies varied between 3 and 8 per cent.

The indications for salpingostomy are enumerated. In general, they embrace chiefly cases with slight changes and only exceptionally those with more serious changes.

The material presented embraces 64 salpingostomies resulting in 3 cases of parturition, 4 ectopic pregnancies, and 1 abortion.

T. FLOYD BELL, M.D.

EXTERNAL GENITALIA

Paracchi, P: Carcinoma of the Clitoris (Il carcinoma del clitoride). *Tumori*, Milano, 1942, 28: 102.

Meyer (in 1868) was the first to describe carcinoma of the clitoris as an entity. Reports of other cases followed, so that up to the present time 358 cases of primary carcinoma of the clitoris have appeared in the literature. To these the author adds all cases treated in the Gynecological Section of the Istituto Nazionale Vittorio Emanuele, in Milan, Italy, from May 1, 1928 to April 30, 1944, i.e., 12 cases of primary carcinoma of the clitoris, 21 cases of carcinoma of the external genitalia with involvement of the clitoris which was no longer recognizable anatomically, and 6 cases in which carcinoma of the clitoris was metastatic from a primary uterine neoplasm. From his observations he comes to the following conclusions:

1. Carcinoma of the clitoris is not so rare when considered in relation to carcinoma involving the external genitalia. Of 3,116 cases of malignant tumors of the female genital organs treated in this Institute since its inception, 96 showed involvement of the external genitalia, and of these, 39 (40.6%) had involvement of the clitoris.

2. In most of the cases the condition occurred between the sixtieth to sixty-fifth years of life. It occurs only rarely in the young.

3. The average beginning of menstruation was at 14 years and 1 month. In only 1 patient had menstruation started at the late age of 28 years.

4. Sexual relations are not considered an etiological factor.

5. Pregnancy and dystocia must be disregarded as a cause. Instrumentation at the time of delivery involves the vaginal fourchette, and this is not the primary location of the neoplasm. Two patients in whom the primary carcinoma was located in the posterior commissure, were nulliparous.

6. The disease is more frequent in women who have had an early menopause.

7. Leucoplakia and kraurosis vulvae must not be considered a precancerous condition; its presence is only coincidental. It takes some imagination to conceive of a leucoplastic cell all at once becoming aggressive, proliferative, disorderly, anarchistic—in one word, a cancer cell. The ovary plays no part in the etiology of primary carcinoma of the clitoris which occurs in old age, and many years after the menopause. Smegma hidden under the prepuce of the clitoris may have to be considered a factor.

The clitoris anatomically consists of the body, made up of erectile tissue as is the penis (the corpora cavernosa being surrounded by a tunical albuginea 1 mm. thick), and the gland made up of squamous epithelium and capped by the prepuce, which is rich in glandular tissue. Therefore, in the clitoris 3 types of tumor may take place: epithelioma, sarcoma, and melanotic tumors.

The epithelioma originates from the squamous epithelioma of the gland, and may be the (1) spinal cell type (55% of the cases) with hyperchromatic poligonal cells and more or less keratinization; the (2) basal cell type (36% of cases) characterized by much mitosis and atypicity of cells, the oblong nuclei being hyperchromatic and karyokinesis frequent; the (3) basal spinal cell type (9% of cases); the (4) adenocarcinoma, a rare type made up histologically of nests of cells surrounding a central cavity and arranged like the lobes of an acinous gland.

The sarcoma is rare, originates from the connective vascular tissue and is characterized by numerous young cells with atypical mitosis. This tumor is very vascular. No cases of sarcoma were found in the author's material.

The melanoma is rare. Frank has stated that pigmented malignant tumors of the external genitalia constitute 2 per cent of all pigmented tumors. The tumor varies in size from that of a pea to a hen's egg, and tends to metastasize to distant parts of the body.

Tumors of the clitoris may assume any of the following forms:

Vegetative—cauliflower-like with a base either sessile or pedunculated; bleeds easily. In the author's material 45 per cent of the cases were of this type. The lesion remains localized for a long time.

Ulcerative—craterlike with indurated edges and a vegetative bottom covered with sanguineous fluid (made up 40 per cent of cases). In advanced cases it will destroy the clitoris completely.

Infiltrative—tends to invade all tissues around it to such an extent as to obliterate the primary location (made up 15 per cent of cases). In 1 case the ischiopubic ramus was invaded.

In carcinoma of the clitoris the anatomy of the lymphatic drainage must be kept in mind, i.e., the lymphatics of the corpus clitoris end in the superficial lymphatic glands, while the lymphatics of the gland empty into the iliac glands by way of the inguinal ring or femoral canal, and knowledge of this fact helps in the diagnosis and also determines the treatment. Neither should one forget that enlarged glands may be inflammatory, and not a metastasis from a cancerous growth.

The most common symptoms are pruritus in the area of the clitoris, burning sensation of the vulva, and some slight pain in the inguinal region and legs; occasionally hemorrhage may complicate ulceration. One of the author's patients developed a massive regional adenopathy followed by ulceration and a massive hemorrhage that killed the patient. The diagnosis is not difficult. In the ulcerative type luetic ulcer and tuberculous ulcer must be differentiated. The final diagnosis rests on biopsy and microscopic examinations.

The prognosis is always guarded. Without surgical intervention life may continue from 1 to 2 years. Three patients (7.5%) recovered completely; 2 are living and well 10 years after operation; 5 are living 3 years after operation; 1 patient is living 2 years and 3 patients, 1 year after operation. Four patients failed to report; 20 died the first year, 6 died the second year, and 1 died the fourth year after operation.

Basset and Tausing advise a two-stage operation, i.e., removal of the inguinal gland at the first stage, and vulvectomy at the second stage. Whenever feasible, the author has performed a one-stage operation followed by radium and x-ray therapy.

JOSEPH M. A. PAPE, M.D.

MISCELLANEOUS

Cruz, H.: Surgery for Female Sterility (Cirugía de la esterilidad femenina). *Arch. Soc. cir. hosp.*, Santiago, 1946, 16: 227.

The author enumerates the etiological factors involved in sterility and the means necessary to correct them. Thorough examination of both partners, male and female, should always be done, each being considered equally responsible for the sterility until the exact cause is ascertained. The contributing factors are grouped into five classes:

1. Genital lesions which may be irreconciliable with fecundation; these should have careful gynecological correction.

2. Cervical secretion hostile to the semen and insemination through the uterus.

3. Tubal pathosis which either partially or completely occludes the orifice.

4. Endocrine hormonal dysfunction which manifests itself in anomalies of the menstrual cycle and ovarian malfunction; this can be determined by endometrial biopsy.

5. Sterility in the male partner. This necessitates complete semen examination.

A complete physical examination in order to ascertain the presence of any general systemic disorder such as syphilis or tuberculosis is necessary.

The genital lesions which cause sterility include genital malformations such as intact, rigid, or imperforated hymen; vaginal atresia or occlusion, or total or partial absence of the vagina; bicervical vaginal septa; and bicornuate uterus.

Malposition of the uterus such as retroversion and retroflexion contributes to endocrine ovarian dysfunction which results either in reduction of the total number of ova or production of imperfect ova, or the development of an abnormal endometrium which prevents proper implantation.

Coexisting with retrodisplacement of the uterus may be such conditions as occlusion or constriction of the tubes, congestion and hyperplasia tending toward endosalpingitis, decreased resistance of the pelvic organs to infection, and endometriosis. Anteflexion may also cause stenosis of the internal os and in this manner prevent fecundation.

Myoma of the uterus has no absolute relation to sterility. When found, however, investigation should look beyond the myomatosis for cause of the sterility. However, sterility may result from mechanical occlusion or compression of the tubal organs, especially when there is endocrine dysfunction or coexisting inflammation of the tubes.

Various techniques of surgical treatment of uterine myoma are described.

Ovarian tumors are in themselves no barriers to pregnancy. The number of complications these tumors produce during pregnancy clearly demonstrates this point. The effect of ovarian cysts on sterility is an open question; various authors cite percentages ranging from 6 to 17 per cent. The manner in which the sterility is produced is also in doubt. The surgical treatment of ovarian cysts need not require sacrifice of the ovary; various operative techniques are presented illustrating this point.

Inflammatory pelvic lesions constitute the most common cause of sterility in women, gonorrhea being the most frequent offender. Tubal tuberculosis, however, should receive special consideration for its surgical management permits of no conservatism in treatment.

There are 2 cervical conditions inimical to fecundation: secretion of substances hostile to the spermatozoa, and closure of the cervical canal. These may be brought about by an endocervicitis, cervical polyp, or stenosis of the external os, and must have appropriate treatment before pregnancy can be expected.

Affections of the tube account for 47 per cent of the sterility in women, the most frequent cause being

gonococcal infections and subclinical tuberculous salpingitis. These contribute to ectopic pregnancy.

Insufflation according to the Rubin technique is considered most useful in the diagnosis of the condition of the tubes as well as being a therapeutic aid in correcting tubal obstruction under certain conditions. The indications and contraindications for hysterosalpingography are given. Surgical correction of tubal obstruction consists in salpingolysis, salpingostomy, resection of the isthmus with end-to-end anastomosis, implantation of the tubes into the uterus, transplantation of the tubal horn, or transposition of the ovary into the uterus.

Endocrine dysfunction accounts for 25 per cent of the sterility in women. Suppression of ovarian function is primary, and is brought about by some pituitary ovarian imbalance. There is insufficient secretion for inducing ovulation or luteinization, or a postinflammatory fibrosis may exist which prevents normal secretion from causing follicular rupture. Polycystic disease follows and surgical methods are usually resorted to for relief.

The masculine element of sterility calls for complete examination of the semen, among other factors, but the author abstains from enlarging on this point, as he considers it beyond the scope of his present theme. STEPHEN A. ZIEMAN, M.D.

Perli, H.: The Treatment of Functional, Traumatic Bladder Incontinence and Vesicovaginal Fistula at the Allmänna BB (Über die Behandlung der funktionellen traumatischen Blaseninkontinenz und der vesicovaginalen Fisteln in d. Allmänna BB). *Acta obst. gyn. scand.*, 1946, 25: 547.

Nineteen cases of women with functional bladder incontinence and 10 with vesicovaginal fistula are reported. Of the 19 patients, 16 exhibited a relative incontinence, that is, the urine loss would occur only under special circumstances (heavy lifting, stooping, coughing, laughing), and 2 an absolute incontinence. In 1 instance there was evidence of diabetes insipidus which was, however, interpreted as a relative incontinence. Seventeen of these women had borne children, and in 9 of these the incontinence appeared immediately following the delivery. Of the 9, 6 had had a spontaneous delivery; in 2 forceps were used; and the remaining patient had undergone extraction of a pelvic presentation. In 4 of the remaining 8 patients, in whom the incontinence had developed gradually in the course of from 5 to 15 years following childbirth, the condition appeared coincidentally with a prolapsus vaginae, and in the other 4 no immediate cause could be found. In 1 of the 2 women who had not borne children the condition appeared following emptying of the uterus, and in the other there was a retroverted myomatous uterus which appeared to have drawn the cervix up behind the symphysis.

Of the 10 cases of fistula, 8 had followed childbirth, with a long period of labor and with large children. In 1 of these 8 the delivery was spontaneous and in 6 obstetrical operations were carried out (3 forceps deliveries, 2 perforations with extraction, and 1 extraction of a pelvic presentation). Of the 2 remaining patients, who had not borne children, 1 had been subjected to extirpation of the uterus following radium therapy and the other had had a paraurethral abscess (urethral fistula).

In 17 of the 19 cases of functional incontinence an anterior colporrhaphy was done and in 13 of these the suture line was reinforced by a muscle plastic operation on the urogenital trigonum or pelvic diaphragm and/or plication or overlapping of the connective tissue of the bladder. The immediate results were good, that is, the involuntary loss of urine was stopped, or as good as stopped, in 78.4 per cent of the cases. However, the answers to follow up letters of those who responded indicated that there was permanent healing in only 54.5 per cent, while the incontinence had recurred in 45.5 per cent, although in no case was it as great as it had been previously. The author believes that the surgeon may be somewhat to blame for these results in that he does not give the patient sufficient instructions for the postoperative period. The patient should not do any heavy work, should not have coitus, and should not even be examined vaginally or have a catheter passed for a period of at least 2 months following the operative repair.

None of the 10 fistulas was firmly adherent to the bony structures of the pelvis, and this must be considered as indicating an especially favorable condition for surgery. Seven of these patients were operated upon according to the method of Fueth, or of Fergusson-Braquehave-Fueth, with closure of the fistula in all. In one of these 7, a preliminary suprasymphysial fistula was created. In 2 of these 7 cases there was a concurrent urethral defect. In 1 of these 2 the fistula was first closed by the method of Fueth, as mentioned, and then at a second operation a new sphincter was formed from the pars pubica levatoris muscle with satisfactory control of the urine. In the other case the urogenital diaphragm was used to reinforce the urethral defect; however, the fistula recurred to a certain extent. In 1 case complete continence was obtained by overlapping with the levator ani muscles, and 2 cases must be considered as failures, although the fistulas closed spontaneously at a later date. In 1 of these 2 failures, in a very corpulent woman, section was first done and a suprapubic fistula created, then the bladder mucosa was freed and stitched transversally; this was followed by continued suture of the paravesical connective tissues. However, a month later the incontinence had recurred and at the second operation the fistula was again carefully repaired. In a few days the condition had recurred in its original location and to the same extent. The patient was later treated repeatedly for infection of the bladder and stone formation, and the fistula finally closed of itself and some degree of urinary control developed. In the second case of failure, 2 operations of repair failed, but the fistula closed later of itself; nevertheless, the incontinence continued. JOHN W. BRENNAN, M.D.

Stanley, M. M.: Gonococcal Peritonitis of the Upper Part of the Abdomen in Young Women (Phrenic Reaction, or Subcostal Syndrome of Stajano; Fitz-Hugh-Curtis Syndrome): Report of Cases of 3 Patients Treated Successfully with Penicillin, and Summary of Literature. *Arch. Int. M.*, 1946, 78: 1.

Peritonitis of the upper part of the abdomen in young women occurring during the course of gonorrhea was first described as a definite syndrome in 1919 by Carlos Stajano. In 1930 Curtis called attention to the frequent coexistence of gonococcal salpingitis and "violin string" adhesions between the anterior surface of the liver and the anterior abdominal wall discovered at operation, conditions indicating presumably a chronic, healing, or healed perihepatitis. Fitz-Hugh, in 1934, described 3 cases in the acute stage. Since then numerous articles have appeared in the literature, and the clinical entity has been well documented.

The purpose of this article is to report 3 typical cases of gonococcal perihepatitis. All 3 patients were treated with penicillin and recovered rapidly.

Invariably, women in whom the syndrome develops have had an antecedent gonococcal infection, sometimes as much as 5 years previously. Often it will be impossible to elicit the usual symptoms of gonorrhea. However, on direct questioning a history will frequently be revealed of menorrhagia or dysmenorrhea, burning on urination, vaginal discharge, or vague pain in the lower part of the abdomen during the few days or weeks preceding the occurrence of frank symptoms of peritonitis.

The onset is usually dramatic. There is the sudden occurrence of excruciating sharp pain in the upper part of the abdomen, usually on the right side, most intense anteriorly under the rib margins and often referred to the top of the corresponding shoulder. It is of the "pleuritic" type, exaggerated by deep breathing, coughing, laughing, and by movements of the trunk. Hiccup may be troublesome. Nausea is of frequent occurrence, but vomiting follows less often. When symptoms are present in the lower part of the abdomen they are usually worse on the side of the phrenic reaction, but they are usually overshadowed by the more acute process in the upper part of the abdomen.

It has been repeatedly recognized that trauma to inflamed pelvic organs, in the form of surgical procedures, gynecological examination, intercourse, or douching may precipitate the development of this complication. One of the most frequently observed types of reaction in the experience of Stajano was the postoperative variety.

The physical examination discloses an acutely ill but not prostrated patient. The temperature is usually somewhat elevated, although rarely above 102°F. There is pronounced tenderness and muscular spasm at the site of greatest intensity of the pain, usually in the right upper abdominal quadrant, which indicates an underlying peritoneal inflammatory process. Occasionally a friction rub is heard. The suspicion of preceding gonorrhea aroused by the finding of slight or moderate tenderness in the lower part of the abdomen is confirmed when other evidences of gonococcic infection—inflammation of Skene's glands or the glands of Bartholin, urethritis, cervicitis, or salpingitis—are discovered. Small pleural effusions, confirmed by the aspiration of small quantities of fluid, are not uncommon.

Other stigmas of gonococcal infection, such as arthritis, tenosynovitis, or keratosis blennorrhagica, may be present.

Culture of the cervical or urethral secretions under proper conditions invariably yields gonococci. This observation is often not confirmed by the examination of stained smears, no matter how painstakingly carried out. Leucocytosis is the rule, although the total count is usually not elevated above 15,000 white cells per cubic millimeter of blood. A very slight, transient elevation of the bilirubin content of the blood may be found. A slightly icteric tinge has been noted. Duodenal drainages were performed on 18 patients in one series with uniformly negative results.

Roentgenological visualization of the gall bladder by means of radiopaque dye reveals a normally functioning organ, without stones, in nearly every instance. A nonfilling gall bladder may occasionally be found.

The roentgenogram of the chest is usually normal except for some elevation of the diaphragm on the affected side.

Although gonococci have not actually been cultured from material taken directly from the subphrenic space at operation, there can be little doubt that they are present. Localized, fairly dry peritonitis involving the anterior surface and edge of the liver, the adjacent peritoneal surface of the diaphragm, and the anterior abdominal wall has been noted. The peritoneum in these areas was injected and had the appearance of salt sprinkled on a moist surface. Presumably, this acute inflammatory reaction subsides in a few weeks and leaves the "violin string" adhesions in the same location.

There appears to be almost no tendency toward abscess formation in the subdiaphragmatic space following its invasion by the gonococcus.

The route of extension of the infection from the pelvis to the subphrenic spaces, whether via the paracolic gutter or through the retroperitoneal lymphatics, is in doubt. Definitely, in some instances, there is direct extension rather than metastasis.

When one is presented with the clinical picture previously described, especially in a young woman, the diagnosis can be made with a high degree of certainty by merely establishing the presence of gonococci in the urethra or cervix. This decision should be made on the basis of culture, and not of smears alone.

The most frequently encountered diagnostic problem is the differentiation of gonococcal peritonitis from acute cholecystitis. Other abdominal conditions from which this disease must be differentiated

include ruptured peptic ulcer, appendicitis with subphrenic abscess, and other forms of peritonitis.

An accurate diagnosis is important, especially in ruling out those diseases requiring surgical intervention, for not only is such interference unnecessary but it may actually be harmful.

There have been no deaths reported as resulting from this type of gonococcal peritonitis. The usual course when it is untreated is slow subsidence of the acute pain to a dull ache which gradually disappears, the whole process requiring from 1 to 4 weeks.

At the present time penicillin is the drug of choice; with doses of 20,000 units administered every 3 hours intramuscularly there is almost complete relief of symptoms after 24 hours of treatment.

Three typical cases of gonococcal peritonitis treated by penicillin are reported by the author.

DANIEL G. MORTON, M.D.

Cilotti, R.: Umbilical Metastases from Tumors of the Female Genitalia (Metastasi ombelicali da tumori dell'apparato genitale femminile). *Riv. ital. gin.*, 1944, 27: 107.

Skin metastases are very rare in malignant tumors, especially in those of the female genitalia. No accurate statistics as to their frequency can be collected from the literature.

The author describes 2 cases of metastasis to the umbilicus. The first was in a woman of 56 who was operated on May 12, 1941 for an adenocarcinoma of the right ovary with extensive adhesions to the omentum and ascending colon. The laparotomy incision did not reach the umbilicus. The patient was readmitted to the hospital March 12, 1942. She was still in good general health with normal genital findings, but the base of the umbilicus was ulcerated and the ulceration was covered with a reddish fungoid growth which bled easily. Fragments removed from the umbilical region showed the same structure as that of the primary tumor. She was given radium treatment and discharged from the hospital March 28. She is still living.

The second case was in a woman of 59. Curettage of the uterus February 13, 1941 showed adenocarcinoma of the body. The patient objected to operation and was given roentgen radium treatment and discharged on May 20, 1941. She was readmitted February 17, 1942 and reported that a small, dark red nodule had been developing in the umbilicus for about 2 months. The nodule was the size of a cherry and surrounded by normal skin, but the surrounding tissue was infiltrated. Examination of a biopsy specimen showed the same structure as that of the primary tumor. Roentgen and radium treatment was given and the patient was discharged with the lesion almost entirely epithelized. She died later, however, in another hospital.

In the first case the adhesions indicated that diffusion of the tumor to the abdominal cavity had already taken place at the time of the operation. From the parietal peritoneum the cells had passed by continuity to the skin following either the interstices of the tissues or the local lymphatic spaces.

In the second case the tumor had apparently not invaded the abdominal peritoneum. However, when the patient was readmitted after a year in poor general condition, the liver was enlarged and it is probable that the tumor had diffused along the lymphatics of the falciform ligament and those of the round ligament and reached the skin. On the other hand, it is possible that the lumboaortic lymph glands first became involved and that the process extended from there to the lymph glands of the liver secondarily; or the tumor may have extended through the lymph glands of the urachus to the umbilicus and then to the liver. These skin metastases do not take place through the blood circulation.

AUDREY G. MORGAN, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Newton, W. H., Theobald, G. W., and Nixon, W. C. W.: Discussion on Water Metabolism in Pregnancy. *Proc. R. Soc., M.*, Lond., 1946, 39: 558.

W. H. NEWTON. The speaker first reviews briefly the general principles involved in the distribution of water in the blood stream, the interstitial spaces, and the cells, and then analyzes the situation occurring during pregnancy. Various balance experiments indicate that during the latter part of pregnancy about 3 gm. of sodium are retained weekly. If this were all osmotically active it would require the storage of about 1 liter of water weekly to dilute it, but as this does not occur it must be assumed that all of the sodium does not exert osmotic pressure. With the increase in plasma volume there may be a decrease in plasma protein which in turn decreases the osmotic pressure in the blood stream and alters the fluid exchange. The legs constitute 37 per cent of the body weight, and the three-fold increase in venous pressure in the lower extremities during pregnancy tends to force water out into the tissues; this may be counterbalanced by increased tissue pressure.

G. W. THEOBALD. The fluid balance in the body is ultimately controlled by the kidney but certain factors may interfere, particularly during pregnancy. The increased blood volume may be compensatory for the increased vascular bed. Dilution of the blood decreases the effective osmotic pressure of the plasma proteins and therefore the protein intake should be high during pregnancy. Increased amounts of sex steroids are responsible for electrolyte retention during pregnancy and, thus, likewise for water retention. Probably all of the sodium is not osmotically active since not enough water can be accounted for if this were true. The average weight increase is about 24 pounds, but estimates of the total nitrogen retention show an average of about 1 pound which is equal to 6 pounds of protein or 30 pounds of new tissue. Since this does not occur it seems obvious that much of the nitrogen is stored as such. Some of the weight increase is due to water retention since edema occurs and since so much water is lost rapidly after delivery. Weight gains which are significant in indicating water retention are sudden gains late in pregnancy; a slow increase over a long period of time is less significant. Excretion of ingested fluid during pregnancy is delayed with the patient in an upright position, therefore bed rest is the best position for the patient in whom there is abnormal fluid retention.

W. C. W. NIXON. Edema is the main clinical evidence of abnormal water metabolism. Pregnancy added to a deficiency state may be associated with edema; this is particularly true in the lack of vitamin B_1. Vulvar edema may be due to protein deficiency. The mechanism of edema is not always understood. Edema is affected by posture, therefore the feet and hands are common sites for the condition. This disappears when the individual lies down. Treatment depends upon the elimination of salt and soda; for the more severe cases the fluid intake should be restricted and the patients given hypertonic glucose solutions intravenously. Plasma may likewise be used.

J. ROBERT WILLSON, M.D.

Moscoso, C. J.: Large Ovarian Cysts with Torsion of the Pedicle Complicated by Pregnancy (Grandes quistes de ovario con torsión de pedículo y embarazo). *Obst. gin. lat. amer.*, B. Air., 1946, 4: 96.

This article relates the fundamentals necessary for diagnosis of an ovarian cyst in the presence of pregnancy, the necessity of distinguishing it from tumors of the liver, bladder, pancreas, mesentery, and intestines, and the symptomatology when a twisted pedicle has occurred. The last depends upon whether or not the torsion is acute or chronic. If acute, three forms are possible: (1) cases in which there is internal hemorrhage, with symptoms of acute anemia and rupture of the viscus; (2) cases in which there is peritonitis, with pain, distention, rigidity, nausea, and vomiting; and (3) cases in which there is mechanical obstruction, with symptoms of intestinal obstruction.

The case histories of 2 pregnant patients are presented, each of whom had a right ovarian cyst with a twisted pedicle.

At operation the tumor in the first patient was found to lie transversely and adjacent to the liver, and that in the second patient fell over to the left side adjacent to the splenic flexure. Both tumors were removed without any disturbance of the subsequent course of gestation.

In the discussion of this rare affection it is thought that pregnancy predisposes to torsion, and when torsion is observed immediate operation is indicated.

STEPHEN A. ZIEMAN, M.D.

Macafee, C. H. G., Phillips, L., Barnes, J., Young, J., and Others: Discussion on Placenta Previa. *Proc. R. Soc. M.*, Lond., 1946, 39: 551.

C. H. G. MACAFEE. Since 1937, 191 cases of placenta previa have been cared for by one staff member of the Belfast Royal Maternity Hospital. The maternal mortality was 0.52 per cent and the corrected fetal mortality 18.8 per cent. Since the main cause of fetal mortality associated with placenta previa is prematurity, carrying the patient to as near term as possible will reduce this rate. This can be done safely if the patient is watched in the hospital as the initial hemorrhage is rarely profuse. Eventually, vaginal examination was carried out after all preparations had been made to deliver the patient, in order to determine the type of placenta previa so that an adequate plan of treatment could be outlined.

L. PHILLIPS. In 139 cases of placenta previa treated at Queen Charlotte's Hospital prior to 1933, the maternal mortality rate was 6.47 per cent and the fetal mortality 52.5 per cent. In the next 143 cases the maternal mortality was 1.4 per cent and the fetal mortality 58.7 per cent. The factors responsible for the reduction in maternal mortality were (1) the better condition of the patients on admittance, (2) the increased use of blood transfusion, (3) the extended scope of cesarean section, and (4) the team work among the obstetrician, the resident staff, and the nurses. All cases were examined under anesthesia to determine the type of placenta previa. In those in which the os was completely covered or in primigravida with a long closed cervix, cesarean section was done. In incomplete placenta previa the membranes were ruptured in vertex positions and a foot was pulled down in the breeches. If bleeding continued, vaginal tamponade was done. The mistakes that might have increased the mortality were: (1) immediate examination in all cases, which increased the fetal mortality, (2) failure to have preparations made for cesarean section, (3) the use of dilators if the cervix was closed, and (4) plugging of the vagina.

J. BARNES. In 140 cases of placenta previa the maternal mortality was 2.9 per cent and the fetal mortality was 52.2 per cent. Of the 71 infants lost, 38 died after a leg had been pulled down to control hemorrhage; prematurity and intrapartum asphyxia were major factors in infant deaths. Of the 4 maternal deaths, 1 followed hemorrhage associated with bougie induction, 1 was due to pulmonary embolism on the seventeenth day, 1 was due to shock, and the fourth was due to septicemia. It is recommended that all patients be treated in a maternity hospital so that sepsis can be avoided and blood be available. Patients should be treated expectantly without vaginal examination in the absence of severe hemorrhage.

J. YOUNG. In 108 cases the total fetal mortality was 19.4 per cent; during the first 6 years of the 10 year study the infant mortality was 29.2 per cent and in the last years, 13.4 per cent. In 33 cases treated expectantly the fetal death rate was 9 per cent.

M. KERR. For the most part, treatment of placenta previa should consist of rupture of the membranes for the less severe cases and cesarean section for the rest.

A. W. PURDIE. In 143 cases treated at the North Middlesex County Hospital there was 1 maternal death from hemorrhage. The fetal mortality was 31.97 per cent. Forty one cases were treated expectantly for from 12 hours to 67 days and in this group the fetal mortality was 25.6 per cent. In the entire series 11 more babies might have been saved by expectant treatment.

R. C. THOMAS. In 182 cases treated expectantly the infant mortality was 23 per cent. By delaying examination it was possible to carry 125 infants to at least 38 weeks and another 25 to at least 36 weeks. The mortality associated with scalp traction was only 12.8 per cent in 47 cases as compared to 57 per cent in 7 breech presentations.

J. HALLWORTHY. This speaker emphasized the fact that if the placenta is situated on the posterior wall, descent of the presenting part may be delayed because of shortening of the true conjugate, and thus hemorrhage might not be controlled. He advocates cesarean section in such an instance.

PRESIDENT. Rupture of the membranes or cesarean section produces the best results; with version, bringing down a foot, or scalp reaction, the mortality is too high. J. ROBERT WILLSON, M.D.

LABOR AND ITS COMPLICATIONS

Wrigley, A. J.: The Problem of Postmaturity. *Proc. R. Soc. M.*, Lond., 1946, 39: 569.

The author, after reviewing the available literature, both in textbooks and medical journals, concerning postmaturity, concludes that the diagnosis can be made only with difficulty and that there is no unanimity of opinion concerning the management of patients who go past the expected date of confinement. He states that the height of fundus, the circumference of the abdomen, engagement or non-engagement of the fetal head, and x-rays are of little help in establishing the diagnosis. The only way in which postmaturity can be determined is by repeated examination of the patient near term with the following points in mind:

1. Unusual fetal size can usually be determined on repeated examination.
2. As the muscles of the fetus develop they acquire more force and the fetus becomes rigid; this is not characteristic of premature or term infants.
3. Since the quantity of liquor amnii does not increase, the enlarging fetus becomes more readily palpable and appears to fill the uterus completely.

When these signs are present, the author assumes that the infant is postmature regardless of the duration of amenorrhea and suggests that the pregnancy be terminated by medical induction of labor followed by surgical induction if the former procedure fails.

J. ROBERT WILLSON, M.D.

Brown, H. O., Thomson, J. M., and Fitzgerald, J. E.: An Analysis of 500 Obstetrical Cases Managed under Continuous Caudal Anesthesia with Pontocaine. *Anesthesiology*, 1946, 7: 355.

The authors review the recent literature concerning the techniques, results, and dangers of caudal anesthesia, and present a detailed analysis of a series of 500 obstetrical cases in which continuous caudal anesthesia with pontocaine as the anesthetic agent had been used. They contend that since only one-tenth as much of the agent is necessary as compared with procaine, the sixfold increase in toxicity of the former drug makes it safer than the latter, the total comparable doses being smaller. In addition to this, the use of 1:1,000 suprarenin as a vasoconstrictor prolongs the anesthetic action, thus further diminishing the total amount of anesthetic agent needed.

The initial test injection (8 c.c. of 0.10 per cent solution) contained 8 mgm. of the drug. Subsequent injections were 20 to 30 c.c., as necessary. The first dose after the test injection usually relieved pain for from 3 to 5 hours but subsequent doses lasted for shorter periods of time.

Caudal anesthesia is indicated for relief of pain during the latter part of the first stage of labor, for delivery of primigravida, to afford rest in prolonged labor, to prevent the need for inhalation anesthesia in premature labor, in cardiac disease, and in eclampsia. The contraindications include inexperience of the operator, local infection, obstetrical complications such as placenta previa, premature separation, cephalopelvic disproportion and contemplated need for uterine relaxation, as for version and extraction. In addition, obesity, deformity, debility, anemia, neurologic disease, hysteria, syphilis, sensitivity to local anesthesia, and pilonidal dimples may be contraindications.

The needle is inserted with the patient in Sims or modified knee-chest position, and is replaced by a catheter, after which the test dose is injected. The criteria used to verify accurate placement of the needle or catheter in the caudal canal are as follows: (1) typical sensation on inserting the needle, (2) contact with bone superficial to needle is made as it advances, (3) the needle parallels the midline of the back, (4) ease of injection, (5) freedom from aspiration of blood or spinal fluid, (6) negative "impact test" over sacrum when 2 c.c. of the fluid are forcefully injected, (7) absence of subcutaneous crepitation when air is injected, (8) sciatic pain with rapid injection, and (9) ability to pass the catheter freely beyond the tip of the needle.

The incidence of operative deliveries was 69.8 per cent as compared to an average of 8.55 per cent of forceps extractions in a total of 6,991 deliveries; occiput transverse or posterior presentation occurred in 19.8 per cent of cases.

Ten babies died; however, in 9, factors unrelated to anesthesia were thought to be responsible. One baby died from aspiration due to the early onset of respiration. There were no maternal deaths.

In 46 (9.2%) of the patients, a fall in blood pressure of more than 20 points was noted, and in 18 the fall was greater than 30 points.

The complications were as follows: The dura was penetrated in 3 instances; the needle broke 4 times; 5 superficial skin infections occurred; 6 patients had severe chills following the injection and in only 4 was there associated fever. Motor and sensory weakness persisted longer than 24 hours in 4 patients (for 6 months in 1 patient). One patient had fecal and urinary incontinence for 11 days; in another patient urinary incontinence lasted for 6 weeks.

Satisfactory anesthesia and analgesia were obtained in 428 cases. Failure to insert the needle occurred in 13 cases; in 28, inadequate time or dosage was responsible for the failure, in 16 technical difficulties occurred, and in 6 the needle was removed for other reasons. J. ROBERT WILLSON, M.D.

Mendelson, C. L.: The Aspiration of Stomach Contents into the Lungs during Obstetric Anesthesia. *Am. J. Obst.*, 1946, 52: 191.

In a series of 44,016 pregnancies at the New York Lying-In Hospital, the author observed 66 cases (0.15%) of aspiration of stomach contents into the lungs during obstetric anesthesia. Gastric retention of solid and liquid material is prolonged during labor and the aspiration of vomitus into the lungs may occur while the laryngeal reflexes are abolished during general anesthesia. Bronchial configuration favors right-sided respiration, but massive aspiration readily involves both lungs.

Aspiration of solid material produces the classical picture of laryngeal or bronchial obstruction leading to massive atelectasis with dyspnea, tachycardia, cyanosis, mediastinal shift, and signs of consolidation over the collapsed area. X-rays reveal a homologous density in the affected area and varying degrees of mediastinal shift.

Aspiration of liquid contents produces an asthmaticlike syndrome. There is cyanosis, tachycardia, and dyspnea, but no mediastinal shift of massive atelectasis. Wheezes, rales, and ronchi are heard over the affected portions of the lungs. Irregular soft mottled densities without mediastinal shift are shown in the roentgenogram. This syndrome is due to the irritation of gastric hydrochloric acid which produces bronchial spasm, and a peribronchiolar exudative and congestive reaction. Animal experiments were carried out.

The author believes that the aspiration of stomach contents into the lungs is preventable, and recommends appropriate precautions. Active treatment is that of relieving obstruction in the first group, and the use of oxygen, ammophylline, adrenalin, and atropine to relieve the bronchiolar spasm in the latter group. EDWARD L. CORNELL, M.D.

Odell, L. D., and Plass, E. D.: Intrapartum Fever. A Preliminary Study. *Am. J. Obst.*, 1946, 52: 89.

Fever during labor may be due to dehydration, extragenital disease, or birth canal infection. The last is diagnosed by excluding the other two, or by the discharge of foul material from the tract. The primary lesion in infections of the genital tract is an amnionitis (placentitis) which subjects both the mother and the child to serious sequelae. In the mother, puerperal infection frequently develops and may be fatal, while aspiration pneumonia and septicemia by direct extension into the placental vessels constitute the chief risks to the child.

In this series of 187 febrile labors, 129 of the mothers presented evidence of birth canal infection alone or in combination with an extragenital factor. In the latter group, 8 mothers and 61 infants died, mortality rates of 6.2 per cent and 46.9 per cent, respectively. Dehydration fever was followed by no maternal or fetal deaths, but pyrexia of extragenital origin (no evidence of uterine infection) led to a maternal death rate of 36.8 per cent and a fetal mortality rate of 42.2 per cent.

Treatment of dehydration fever and of extragenital diseases followed the usual methods. On the other hand, therapy of intrapartum birth canal infections has been significantly and favorably altered by recognition of the dangers involved and by the use of the newer antibiotics, the sulfonamides, and penicillin, prophylactically and curatively.

EDWARD L. CORNELL, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Vara, P.: Puerperal Infections and Sensitiveness to Streptococcal Toxins. *Acta obst. gyn. scand.*, 1946, 26: 413.

This article deals with an attempt to determine (by means of the Dick skin test) which obstetric patients may be more susceptible to puerperal infections.

The author presents a statistical review of puerperal infections observed in the Women's Division of the Helsinki University during the 20 year period from 1925 to 1944. This review reveals a definite reduction in the incidence of the mild forms of endometritis but none in the incidence of septic endometritis with the hemolytic streptococcus and blood stream invasion.

The results of intracutaneous tests performed on 1,000 women at term were as follows:

Incidence of Reaction to Dick Test Per cent	Incidence of Infection Per cent
+ 6.9	5.88
± 12.6	4.38
− 80.5	1.30

Serious infections were likewise more common in the first two groups. Internal examinations and manipulations raised the incidence of infection in all groups, but to a less degree in the Dick negative group. The author concludes that the test should be made routine so that the Dick positive and Dick positive/negative group may be handled with greater care and provided with prophylactic chemotherapy.

JAMES F. DONNELLY, M.D.

MISCELLANEOUS

Quigley, J. K.: An Analysis of Maternal Deaths for 12 Years in Monroe County, Including Rochester. *N. York State J. M.*, 1946, 46: 1929.

The analysis of maternal deaths for a 12 year period in Monroe County, New York, is presented. A total of 232 deaths are recorded among 81,446 births for the period from 1933 to 1944, or a maternal mortality incidence of 2.8 per 1,000 births. Accidents and complications incidental to early pregnancy accounted for 50 deaths, which would materially reduce the term or near term incidence. Thirty-two deaths were directly due to infected or septic abortion, 3 to abortion without sepsis, and 15 to ectopic pregnancy.

Puerperal septicemia accounted for 15.9 per cent of all the deaths, puerperal hemorrhage for 12 per cent, and toxemias for 12.5 per cent. There were 26 instances of eclamptic death, of which 15 were judged to have occurred following adequate prenatal care. However, a more critical breakdown of statistics showed that from 1933 to 1937 there were 16 deaths due to eclampsia among 29,607 deliveries, or 1 in each 1,850, while from 1938 to 1944 there were only 10 deaths among 51,839 deliveries, or 1 in each 5,184.

Phlegmasia and embolus with sudden death occurred 26 times, or in 11.2 per cent of the total. There were 40 deaths (17.2%) due to extrapuerperal causes such as heart disease, pneumonia, and various surgical complications.

GEORGE BRADBURN, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Sabadini, L.: The Value of Early Pyelography and Functional Tests in Contusions of Kidneys (Valeur de la pyélographie précoce et intérêt des examens fonctionnels au cours des contusions du rein). *J. urol. méd.*, Par., 1944–1945, 52:305.

The danger of infection by the contrast medium and the aggravation of hemorrhage by traumatism militate against pyelography in renal contusions, according to the prevailing opinion. The author does not share this view because the contrast medium is sterile and even possesses bactericidal properties, and the procedure does not cause any trauma.

He employed early pyelography in 8 patients with intrarenal and 7 patients with extrarenal lesions. The opaque medium was injected in the course of a few hours after the accident, after termination of the shock. Ureteral catheters were never occluded by blood clots. In spite of the fact that no prophylactic measures had been employed, no infection followed pyelography, and the slight elevation of temperature observed in only one patient was attributable to pulmonary complications.

Even repeated procedures did not aggravate the symptoms nor produce any infection or recurrence of hemorrhage.

As to the value of pyelography in renal contusions, the studies may reveal the location of the lesion and involvement, if any, of perirenal tissues. In minor injuries negative x-ray findings strengthen the sense of security, while in more serious injuries absence of evidence of grave lesions in roentgenograms suggests conservative treatment. Finally, in very serious injuries the corresponding findings corroborate the clinical diagnosis. Occasionally pyelography may reveal serious lesions not detectable by clinical examination.

Elevation of the left side of the diaphragm and its immobility, combined with the presence of dullness in the lower left thoracic region, confirm the diagnosis of perirenal hematoma.

Functional tests of kidneys are also valuable for the evaluation of the condition, particularly from the medicolegal viewpoint.

The author emphasizes the relatively small diagnostic value of hematuria; even a considerable hematuria of relatively long duration does not indicate a grave contusion.

The opaque medium should be injected very slowly through ureteral catheters, with the patient in Trendelenburg position. If an intrarenal cavity is disclosed, a perirenal hematoma is small or absent, and the patient is in good general condition, no exploration is indicated.

If the contrast medium enters the renal parenchyma and perirenal tissues, a suture of the kidney is indicated if the contusion is not very extensive and the general condition of the patient is serious. If the perirenal hematoma is apparently not very extensive, the contusion of the renal parenchyma is marked, and the general condition of the patient is satisfactory, an expectant treatment is indicated and repeated x-ray studies are desirable.

JOSEPH K. NARAT, M.D.

Hinman, F.: Hydronephrosis. The Surgical Treatment. *Surgery*, 1946, 20: 337.

The author presents a comprehensive review of the accepted methods of treating hydronephrosis. He stresses the fact that the first principle in treatment is diagnosis, which includes not only the proof that the condition is present but a demonstration of its cause, degree and complexity. Obstruction to the urinary flow may be unilateral or bilateral and may be located in the upper or lower portion of the urinary tract. The resulting back pressure effects may be small or large, and may be accompanied by

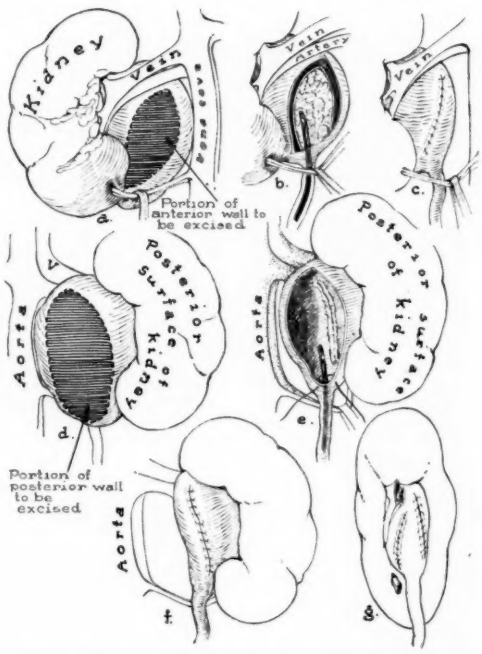


Fig. 1. (Hinman, F.) Method of partial pelvectomy after pyeloureterolysis. *a.* Oblong area to be excised anteriorly; *b.* corresponding oblong area posteriorly (seen through anterior opening) to be excised; *c.* appearance after anterior closure; *d, e, and f.* closure of posterior wound; *g.* pelvis reduced to almost normal size with good ureteropelvic outlet.

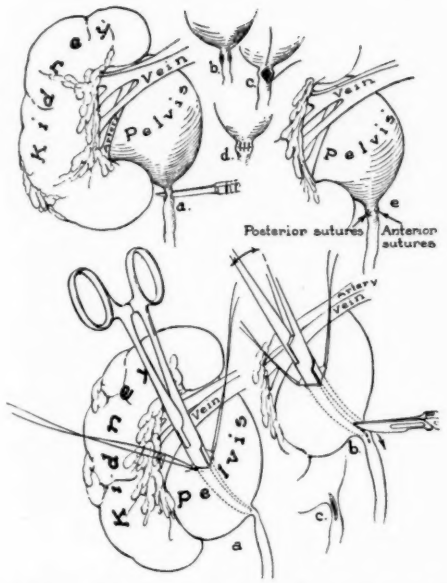


Fig. 2. Longitudinal incision with closure after method of Heineke-Mikulicz. Lower diagrams illustrate *a*. insertion of tip of curved clamp through an opening in pelvis into the area of constriction; *b*. incision made upon tip of this clamp as a guide; and *c*. incision before closure. Upper diagram illustrates how a double incision (*a* and *b*) with closure (*c* and *d*) will secure additional dilatation, *e* (Gibson).

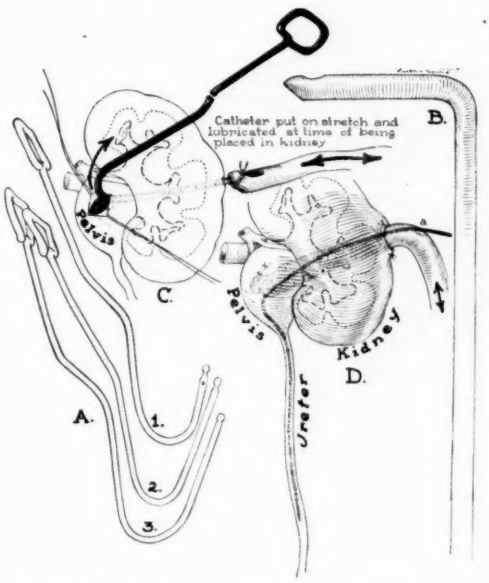


Fig. 3. The nephrectomy tube and ureteral splint. *a*. The metal guides of various sizes and shapes (1, 2, and 3), the one which is most suitable being selected. *b*. Nephrostomy tube (angulated suprapubic drain). *c*. The metal guide inserted retrograde through an opening in the pelvis with the tube (suprapubic drain) tied to its end by heavy silk suture; *d*. tube and splint in place. (The metal guide pulls the tip of the tube to the pelvic opening. The heavy silk tie is cut. The catheter-splint is passed down the tube through a slit in it at *a*, and is then threaded on down the ureter through the opening of the pelvis which is then closed, as shown here by 2 interrupted sutures.)

secondary effects elsewhere which add to the degree of renal obstruction independently and thus complicate the therapeutic problem.

The aim of treatment is always the preservation of renal tissue with the least risk. Occasionally, noninterference is wisest, but usually there is a choice between doing one or more of several different procedures.

Two distinct types of hydronephrosis are recognized: an insular hydronephrosis, which is an isolated pyelectasis and hydronephrotic atrophy of pure ureteropelvic origin, and a hydronephrosis similar pathologically, but due to obstruction and accompanied by changes below the ureteropelvic junction.

The point of view that any hydronephrosis not completely functionless should be repaired is condemned. The patient gains little from the repair of a kidney which would not be able to maintain renal function in the event of the loss of the opposite kidney. However, if an uninfected hydronephrotic kidney is capable of performing anywhere near one-fourth to one-fifth of total function, and it is believed that after relief of the obstruction the renal parenchyma of the hydronephrotic kidney has reserve potentialities which would permit its renal units to hypertrophy upon stimulation, as would happen when some disaster struck its compensatory mate, repair of the hydronephrotic kidney is indicated. In cases of bilateral hydronephrosis, repair of the poor side first is the rule because (1) postoperative renal insufficiency and the danger of anuria will be less and (2) an optimal degree of repair of both kidneys will be secured. In the event of a decision to perform bilateral repair, the second operation should not be delayed too long.

A classification of plastic repair operations for insular hydronephrosis is presented, and each procedure is listed and illustrated. These procedures have been grouped as follows:

1. Pelvioureterolysis, with retrograde dilatation, division of aberrant vessel, partial pelvectomy or pelvic plication (Fig. 1).

2. Incision of the stenosis (when the obstruction has not been removed by pelvioureterolysis) by simple longitudinal incision (Fig. 2), "Y" incision, "W" incision, or multiple longitudinal incisions, or the ureteral wall down to the mucosa at the site of stenosis without suturing.

3. Reimplantation of the ureter into the pelvis (when the insertion is high or when it seems wise to preserve the blood supply of the aberrant vessel) by complete separation of the ureter and reanastomosis, or by lateral (side-to-side) ureteropelvic anastomosis without separation.

4. Combination of one or more methods with ureteral splinting and nephrostomy or pyelostomy (Fig. 3), nephropexy, and/or denervation.

In the treatment of hydronephrosis resulting from obstruction below the ureteropelvic junction, removal of the cause of obstruction is the first consideration. Secondary changes resulting from obstruction, such as vesical diverticulum, ureterovesical stenosis, and valve formation from an elongated tortuous hydroureter may necessitate further procedures which include diverticulectomy, ureteral meatotomy, reimplantation of the ureter into the bladder, or complete ureterolysis with partial ureterectomy.

CLARENCE V. HODGES, M.D.

BLADDER, URETHRA, AND PENIS

Frumkin, A. P.: Repair of Defects and Fistulas in the Urinary Bladder. *Am. Rev. Soviet M.*, 1946, 3: 484.

Gunshot wounds of the anterior bladder wall with destruction of the pubic bones and lower part of the abdominal wall usually run a grave course because of the seepage of urine into the prevesical and perivesical cellular spaces together with the protruding bone splinters which encourage the spread of pelvic cellulitis, osteomyelitis, and wound sepsis. These wounds are usually caused by mines which explode at close range and by dum-dum bullets which pass through the soft tissues of the buttocks and shatter the bones of the true pelvis. Healing usually results in the formation of a large firm scar and shrinking of the wound ceases when the regenerative capacity is exhausted. A deep chronic fistula is formed in the bladder or a large defect remains in the anterior bladder wall. The mucous membrane of the posterior wall and parts of the bladder fundus protrude from this defect. Aspiration of urine or emptying by means of the retention catheter are ineffective.

Closure of such fistulas or defects of the urinary bladder by mobilization of the tissues of the anterior abdominal wall and bladder usually results in the separation of stitches and recurrence of the urinary abdominal fistula. In bladder operations, the principles applied in maxillofacial surgery are used; closure of oral cavity defects shows that optimal growth of mucous membrane is obtained over a muscular lining. Accordingly, the author excises the scars and frees the anterior and posterior bladder walls from adhesions. The margin of the defect is freshened. The posterior bladder wall is separated from the peritoneum, brought forward, and sutured transversely to the inferior edge of the bladder wound. Extensive mobilization of the lateral walls is inadvisable because vascular injuries occur which interfere with nutrition of the bladder wall. A pedicled flap, from 3 to 4 cm. wide and from 10 to 12 cm. long, is cut from the lower part of the rectus muscle at its attachment to the pubic bone, and the free end of the flap is brought down to cover the suture line of the bladder and fixed with interrupted catgut. When extensive destruction of the anterior abdominal wall is present, a flap of the abdominal rectus muscle, about 5 cm. long, is excised at the level of the umbilicus together with its aponeurosis; by means of two slits parallel to the direction of the fibers of the abdominal oblique muscle an aponeurotic pedicle is cut from the aponeurosis of the external oblique muscle, the same length as the muscular flap. The pedicle is excised together with the vessels and nerves, to obtain a muscular flap on a vascular aponeurotic pedicle. The flap is directed downward, fixed transversely over the suture line of the urinary bladder, and attached partly to the bladder and partly to the lateral edges of the wound defect of the anterior abdominal wall.

In another cited case, the gracilis muscle was grafted to supply the injured mucous membrane with a muscular lining, a skin tube was cut out between two longitudinal slits 20 cm. long in order to form a Filatov flap, and in the lumen of this tube the middle third and part of the lower third of the gracilis muscle was inserted. The skin defect under the Filatov flap was closed by the Douglas method of skin grafting. Later, the distal end of the Filatov flap was cut off, and a length of 8 cm. of muscle was extracted from its skin sheath, laid on the bladder suture, and fixed with interrupted catgut. The skin end of the flap was loosened to form a funnel shaped opening and was fixed with interrupted silk sutures to the skin of the anterior abdominal wall. This technique of muscle grafting provides replacement of part of the bladder wall by striated muscles, which forms a firm lining for the inner surface to be covered by mucous membrane. DAVID ROSENBLOOM, M.D.

Cecil, A. B.: Repair of Hypospadias and Urethral Fistula. *J. Urol.*, Balt., 1946, 56: 237.

The author has designed an operation for the repair of hypospadias which is intended to correct a fault inherent in the classic Bucknall procedure. In the Bucknall method, the skin of the scrotum is utilized to form a part of the urethra and cases have been reported in which it was necessary to remove calculi which had formed on the hairs of this skin. The author recommends formation of the urethra from the skin of the penis.

Diversion of the urinary stream is secured by perineal urethrotomy. The urethra is formed distal to and including the hypospadiac opening by throwing up longitudinal skin flaps to form a tube (Fig. 1). The newly formed urethra is then buried in the scrotum by a midline incision in the scrotum. At a later date, after healing has occurred, the scrotal skin is incised around the penis to leave a wide skin margin; the penis is freed from the scrotum and drawn upward, carrying the urethral tube with it;

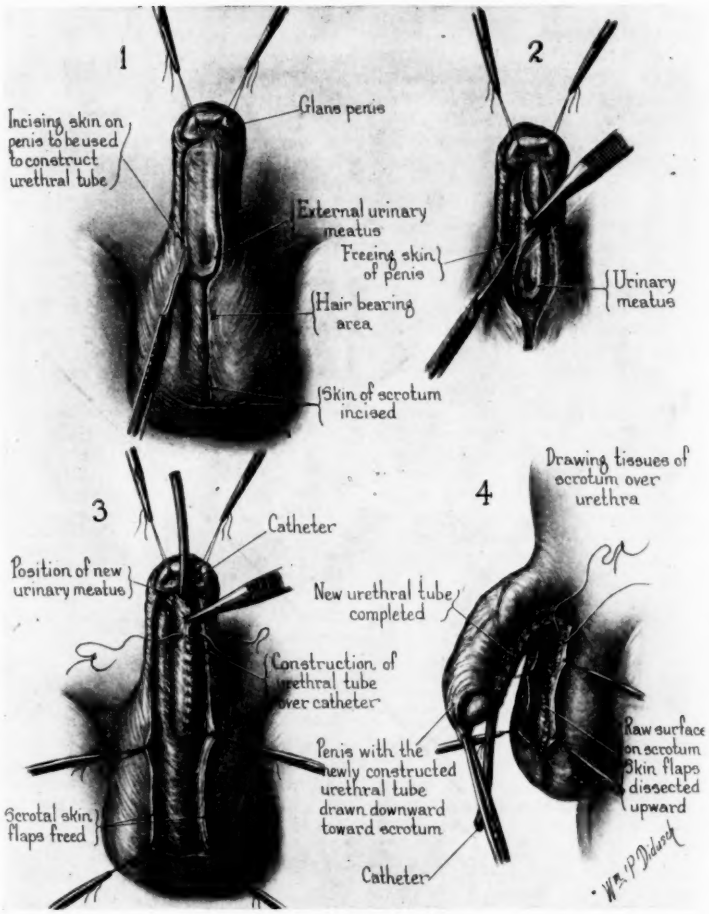


Fig. 1 (Cecil, A. B.)

the scrotal skin is sutured over the urethra, and the skin defect remaining in the scrotum below is sutured.

The author states that slight variations of this operation make it applicable to the cure of one or any number of urethral fistulas, no matter of what degree. CLARENCE V. HODGES, M.D.

GENITAL ORGANS

Hansen, T. S.: Fertility in Operatively Treated and Untreated Cryptorchism. *Acta chir. scand.*, 1946, 94: 117.

The object of this work was to investigate the fertility in operatively treated and untreated cryptorchism on the basis of sperm examinations carried out according to modern methods. On the basis of the sperm examinations, the presumed impairment of fertility is classified as "slight," "moderate," and "severe," the frequency of abnormal heads, the amount of the ejaculate, and the motility being at the same time taken into consideration. Sterility has only been inferred in cases of aspermia. The material comprises 124 patients in all.

Examination of the sperm from 9 patients with untreated bilateral cryptorchism revealed aspermia in all cases, and thus sterility.

Examination of the sperm from 25 bilaterally cryptorchic men treated with orchidopexy revealed 14 cases of sterility, 4 of presumably severe, 2 of moderate, and 3 of slight impairment. In 2 cases only, no sign was found of an impairment of fertility.

These results show that the fertility in bilateral operatively treated cryptorchism is essentially poorer than the literature would seem to show.

Examination of the sperm from 36 patients treated with orchidopexy owing to unilateral cryptorchism, showed 3 cases of sterility, 4 of presumably severe, 4 of moderate, and 10 of slight impairment of fertility, while 15 exhibited no signs of an impairment of fertility.

Examination of the sperm from 35 patients with untreated unilateral cryptorchism revealed 1 case of sterility, 7 of presumably severe, 3 of moderate, and 11 of slight impairment of fertility, while 13 exhibited no signs of an impairment of fertility.

A comparison of the two materials of unilaterally cryptorchic men shows that both the separate items of the sperm examination and the fertility estimates are very nearly identical. In addition it is seen that the patients in the author's material produce, on an average, half as many spermatozoa as the men of a large normal American material. This result and the identity between the examinations of treated and untreated cryptorchic men would seem to show—like the examinations of the operated upon bilaterally cryptorchic patients—that no essential production of spermatozoa takes place in the operated testes.

On the basis of these investigations, certain lines of treatment are suggested which are deemed advisable in the various forms of cryptorchism. Unilateral cryptorchism requires no treatment with a view to fertility. In bilateral cryptorchism a possible spontaneous descent should be awaited, occasionally in connection with hormonal treatment. Bilateral orchidopexy should not be performed lest it result in bilateral testicular atrophy.

JOHN E. KIRKPATRICK, M.D.

Hultberg, S.: Results of Treatment with Radiotherapy in Carcinoma of the Prostate. *Acta radiol.*, Stockh., 1946, 27: 339.

One hundred and sixty-seven cases of carcinoma of the prostate treated by irradiation at Radiumhemmet from 1929 to 1940 are reviewed. Of these, 107 were inoperable and these received radiation therapy alone; 46 cases received postoperative radiation therapy, and 15 of these had been subjected to a previous radical operation. In 14 patients with local recurrences or metastases after a previous operation, radiation therapy was given. The author believes that the perineal approach gives a better exposure and the opportunity to diagnose prostatic carcinoma at an earlier stage. By this route a more radical removal of the lesion and a better ultimate result is attained.

Of the inoperable patients, 16 per cent survived for more than 3 years, and 5½ per cent for more than 5 years. Of the patients who were operated upon, 38 per cent survived more than 3 years and 20 per cent more than 5 years.

Seventy patients received only x-ray therapy, 25 teleradium, and 65 a combination of both. Of those treated with x-ray alone, 13 per cent lived for more than 3 years and 1.4 per cent for more than 5 years. Among the cases which were treated with teleradium alone or in combination with x-ray, 24 per cent survived for more than 3 years, and 12 per cent for more than 5 years.

Those patients who had metastases on admission or who subsequently developed them had an average period of survival of 12.9 months from the time when the metastases were first demonstrated.

FREDERICK A. LLOYD, M.D.

Vest, S. A., and Frazier, T. H.: Survival following Castration for Prostatic Cancer. *J. Urol.*, Balt., 1946, 56: 97.

Vest and Frazier state that from a study of the literature reasonably correct evaluations of some of the itemized topics are evident, while in other instances data are presented which give diametrically opposed impressions.

1. Symptomatic improvements: (a) relief from pain for varying periods of time; (b) relief of symptoms of urinary tract obstruction to a varying degree (bleeding, residual urine, improvement of infection); (c) improvement of general well being (strength, vigor, appetite, weight, anemia)
2. Value of hormone control therapy in producing regression of the local and metastatic growth of prostatic cancer
3. Value of serum acid and alkaline phosphatases in diagnosis and prognosis
4. Histological changes in the cancerous tissue following hormone control therapy
5. Therapeutic effects relative to grade or differentiation of the cancer
6. Changes in the hormone excretion pattern in the urine from both quantitative and qualitative standpoints
7. Response to orchectomy in patients of different age groups
8. Results of treatment when compared to the duration of disease before the treatment was instituted
9. Evaluation of orchectomy as prophylaxis against local growth, extension of the tumor, and metastases
10. Consideration of the results in so-called prophylactic cases or those with early nonmetastatic cancer as compared with those in cases with metastases
11. Value of castration versus estrogenic therapy
12. Value of the various estrogenic substances alone, before, with, or after castration
13. Effect of various estrogenic substances on tissues other than the prostatic cancer
14. Effect of x-ray therapy directly to the adrenals and pituitary gland in combination with other hormonal control methods
15. Life expectance or survival after hormone control therapy as compared with that following the many other therapeutic procedures which have been used to combat this disease.

In a study of the literature it is evident that much more time must pass before many of the numerous questions concerning effects following hormone control therapy can be answered. One of the most important questions concerning orchectomy for prostatic cancer is the possible effect on survival time following treatment. The survival time in the last analysis is certainly the best statistical measure of any therapeutic procedure. There exists a complete lack of uniformity in presenting statistics pertinent to survival rates following hormone control therapy. Many others fail to report closed series of cases, and following closure at least 2 years must elapse before any report of value can be made.

Another extremely important question following orchectomy or estrogenic therapy is whether or not treatment should be instituted early in the course of the disease before metastases have occurred, or whether treatment should be withheld until late in the disease when the symptoms, extension, and metastases are severe. A number of years will be necessary, as well as a larger number of cases, before definite evidence can be obtained as to the survival of life in patients following orchectomy for prostatic cancer. The final basis for any conclusions or deductions must necessarily be based upon comparison with results in cases treated by methods before the use of hormone control therapy.

The authors report their series of 74 closed cases (series closed December 31, 1943) and try to compare these with the 5 other reports in the literature. They suggest that authors in the future report the number of patients that died in successive 6 month intervals. There is no reported series of cases before the advent of hormone control therapy that is comparable to the series reported at present, with the result that a reasonable evaluation of this modern hormone control treatment cannot be made. More studies of survival time are stressed, and authors are urged to report cases so that comparative studies and conclusions can be made. DAVID ROSENBLOOM, M.D.

Nesbit, R. M., and Lynn, J. M.: Malignant Testicular Neoplasms. *Surgery*, 1946, 20: 273.

This study is based on 80 cases of malignant disease of the testicle which have been followed up for 4 years or longer.

The youngest patient was 2 years of age, the oldest 66, and the average age for all the patients was 35.7 years. The average duration of symptoms before diagnosis was 20.5 months; the shortest duration of tumor was 1 week, and the longest 15 years. Neoplasm in an undescended testicle occurred 4 times. Attention should be called particularly to the 3 patients in this group whose presenting clinical picture and history closely resembled acute epididymitis.

Malignancies of the testes are known to metastasize early, although no dissemination could be clinically demonstrated in 51 of the group of patients when they first came under observation.

The ideas of various writers with regard to hormone assays on the urine have differed rather widely in the past. Ferguson once believed that the type of tumor that would be diagnosed microscopically and the presence of metastases could be rather accurately predicted in many cases from the prolan level. More recent work, however, by Dean, Hinman, and others indicates that a negative response to a test for prolan means nothing, but that a positive response dictates a grave prognosis. The titer of prolan A should be at least 500 mouse units, or luteinizing hormone should be present before the test is considered significant since low levels may be due to the follicle stimulating hormone present in the urine of castrates.

The question arose as to whether a tumor which gave rise to a negative Aschheim-Zondek test before therapy would ever cause a positive reaction after treatment. Since metastases from teratoma testis are often more malignant microscopically than the primary focus from which they originated, one would postulate an affirmative answer to this query.

If the Aschheim-Zondek test is positive the outlook for survival is grave. Of 8 patients having hormone levels above 500 mouse units before treatment, only 2 are living. One of these patients had chorioepithelioma and there was no recurrence 12 years after operation. (The case is being reported completely elsewhere.) All 8 patients with positive determinations after therapy are dead.

Nineteen patients were treated by simple orchiectomy, and 5 (27.4 per cent) are alive after an average period of 9.3 years. The authors definitely agree that persons with testicular malignancies other than chorioepithelioma should have postoperative x-ray therapy to the pelvis and abdomen whether or not metastases can be demonstrated.

The assertion has been made that if neoplastic disease of the testicle could be diagnosed early enough, a great many more of the patients could be saved through the benefit of early operation. Accordingly, the 51 patients without demonstrable metastases were divided into two groups: those who were treated within 2 months of onset of symptoms and those treated more than 2 months after the onset of symptoms. Six of 10 treated "early" and 13 of 41 treated "late" are living. Application of the chi square formula to these figures reveals no significant difference, and although one might assume that early treatment would yield better results, the authors were unable to prove that such is the case.

The use of preoperative irradiation for the testicle which is the site of a neoplastic process has been a point of considerable controversy, and a conclusive answer to the question can probably not yet be given. Arguments against preoperative x-ray treatment are as follows: (1) the leaving *in situ* of a very malignant neoplasm which is known to metastasize early and (2) the possibility of incorrect diagnosis because x-ray therapy sometimes renders subsequent microscopic interpretation difficult or impossible.

In the literature one finds frequent mention of radical retroperitoneal lymph gland dissection for testicular cancer—the Chevassu-Hinman operation.

It has been demonstrated that in 90 per cent of bodies there is a communication of the retroperitoneal lymph chain with glands above the renal pedicle and into the chest, and for this reason most surgeons have abandoned this procedure.

In studying the series of cases one conclusive fact has been brought to light: that a metastatic neoplasm which fails to regress or which becomes clinically evident following initial irradiation will not respond favorably to additional deep therapy. The average survival of patients was 12 months.

For the clinician, chaos is the only word which adequately describes the present conflict of opinion regarding the pathology of testicular neoplasms. For this reason no attempt has been made to correlate survival, method of treatment, and the pathologist's opinion of tumor tissue examined microscopically. The chief difference has been that some hold to the theory that all testicular tumors are teratoid in origin (advocated by Ewing and followers), while others maintain that the seminoma is a distinct entity not arising from totipotent cells (Chevassu and disciples). JOHN A. LOEF, M.D.

Korhonen, A.: Nonspecific Acute Epididymitis (Sur les epididymites aiguës non spécifiques). *Acta chir. scand.*, 1946, 93:270.

During wars, infectious diseases which in normal times occur only sporadically are often observed in almost epidemic proportions. One of these is nonspecific acute epididymitis.

The author discusses a series of 40 cases observed in the Finnish army during active service in the last war. The disease starts with low grade fever of about 1 week's duration, and pains and swelling in the caudal part of the epididymis; it is practically always unilateral. Although the fever never exceeds 8 days, the swelling subsides very gradually, full restitution ad integrum taking place usually after from 4 to 6 weeks. The swelling may increase up to the size of a hen's egg, but almost always it involves the caudal part only; in rare cases, secondary involvement of the superior part and of the ductus deferens occurs. As to the laboratory findings, the most significant one is a rise of the sedimentation rate to between 20 and 30 (Westergreen), which was observed in all cases. In no case was there any discharge from the urethra, nor was any pathologic change in the prostate gland ever observed. The urine was normal in all cases except for a few white cells; bacteria were never found in the urine.

The treatment included bed rest, cold applications, and small doses of sulfathiazole during the first week. The prognosis is good, and recurrences are very rare.

As to the etiology, the author rejects the theory that the disease is caused by staphylococci of low virulence; he believes that the epididymitis is a hematogenous infection caused by an unknown virus. It seems to be highly contagious under poor hygienic conditions although the way of transmission is unknown. In overcrowded places as in underground shelters, contact infection seems to play the most important role.

Treatment should always be strictly conservative. Surgery is definitely contraindicated unless the disease becomes chronic, but this did not occur in any of the author's cases. In its course and epidemiology, the disease shows great similarity to infectious hepatitis. WERNER M. SOLMITZ, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Mathez, J. A.: The Problem of Osteochondritis Dissecans. The Cause of the Constant Convexity of the Base of Its Niche and the Explanation of Its Frequent Occurrence in Cretinism (Le problème de l'ostéochondrite disséquante; la raison de la convexité constante du fond de sa niche; explication de sa fréquence relative dans le crétinisme). *Presse méd.*, 1946, 54: 211.

Dequervain and his associates observed that osteochondritis dissecans very frequently occurred in cretins. Based on the experiments of a number of authors it is well established that osteochondritis dissecans is caused by a "force of vibration." A vibrating force of moderate intensity exerted on the femoral condyle forms a "zone of Looser." A more intense force causes a discrete separation of the osseous tissue.

Osteochondritis dissecans is always found at the apex of the curved femoral condyle and opposite one or the other of the tibial spines. It occurs most frequently opposite the medial tibial spine. If one compares a femoral condyle with a ball one readily understands what takes place in a knee afflicted with osteochondritis dissecans. A force exerted on the femoral condyle (or a ball) will show the greatest amount of compression in the center of the impact. The slope of the compression levels off radially from the center of the impact. This theory also holds true in cases of osteochondritis of the elbow joint and of the hip joint.

There are cases of osteochondritis dissecans which are not associated with any pain. As long as the pathological changes are confined to the "Zone of Looser" the condition usually remains asymptomatic. When the osseous structures are fissured pain usually is present. Barth believes that the posterior cruciate ligaments are responsible for the occurrence of osteochondritis dissecans. The author raises the question as to how the posterior cruciate ligament can be made responsible for the constant convexity of the base of the "niche."

Osteochondritis dissecans most frequently occurs in the knee joint. The menisci are the stabilizers and shock absorbers of the knee joint. Therefore, it is clear that a torn medial meniscus will diminish the resistance of the femoral condyle to the "force of vibration." Bircher reported in 1929 the frequent occurrence of torn menisci and osteochondritis dissecans in the same knee joint. Henschen has demonstrated that the soft tissues of the body are liable to be "fractured" by vibration just as well as by the firm bony structures. Fromine reported in 1921 that the "zone of Looser" responds very satisfactorily to rest and it was his belief that prolonged complete rest could lead to disappearance of the osteochondritic lesions.

The occasional occurrence of bilateral symmetrical osteochondritis dissecans lesions make it impossible to accept Axhausen's theory of vascular impairment or the theory of Barth that osteochondritis dissecans is caused by the posterior cruciate ligaments. It is the author's opinion that in these cases the congenitally sharply pointed curvatures of the femoral condyles favors the occurrence of symmetrical osteochondritic lesions in both knee joints.

The histological findings also favor the author's point of view. The picture is that of necrosis rather than that of inflammation.

In the surgical clinic at Zurich, Howald has shown that in cases in which the x-rays show bony fragments within the osteochondritic lesions he was never able to find loose intra-articular bodies. At operation he found that the articular cartilage covered the lesion and that it was therefore hard to find. The fragments visible on x-ray examination represent necrotic bony fragments which often become completely absorbed. Howald states that when this occurs loose bodies appear within the joint cavity. Soon after the bony fragments become absorbed the overlying articular cartilage detaches and lies freely in the joint cavity.

All this can be explained along the lines of the author's theory of the pathology of osteochondritis dissecans. A trauma will loosen the less flexible bony structures sooner than the elastic cartilage. The loosened bony fragments are deprived of their source of nourishment and will readily undergo necrosis. The articular cartilage, however, will continue to get it's nourishment by osmosis from the synovial fluid.

The fact that osteochondritis dissecans occurs in cretins with thyroid and parathyroid disturbances can be explained by the fact that because of these disturbances the bony structures become weakened. The cubitus varus, so frequently observed in cretins, is due to a deformity of the distal humeral epiphysis. This deformity is caused by the fact that the child walks on its hands and knees and that the weakened bony structures of cretins become deformed. The same reason holds true in the formation of coxa vara in cretins. Feistman examined 34 hip joints of cretins and found 32 of them deformed. Bircher has found that the ossification of the long bones is disturbed in cretins. There is an irregular number of ossification centers in the long bones of cretins. Wegelin reports that the normally found areas of softening and degeneration of the articular cartilage were greatly increased in cretins.

The weakness of the cartilage of grown cretins is illustrated by the defects found in the cartilage which have occurred after the ossification of the epiphysis had been accomplished.

In conclusion, the author points out that the constant occurrence of a convexity at the base of the

"niche" is due to the architectural structure of the femoral condyle. The base of the "niche" represents the "zone of Looser" of a vibration fracture.

GEORGE I. REISS, M.D.

Kleinberg, S.: Incipient Epiphyseolisthesis of the Hip. Its Diagnosis and Treatment. *Am. J. Surg.*, 1946, 72: 190.

Epiphyseolysis of the hip indicates a slipping of the head of the femur. Based on the gross pathology and therapeutic possibilities there are four stages: (1) the incipient stage, (2) the stage of moderate slipping, (3) of severe slipping, and (4) of acute slipping.

The final outcome of types 1 and 4 is usually very good and results in a normal hip. However, the result in types 2 and 3 usually is unsatisfactory. The disability is so severe in these cases that major surgery such as transpositional oeteotomy, arthroplasty, and arthrodesis of the hip joint becomes necessary. The etiology of this condition is as yet not well established. Endocrine disturbance such as Frohlich's disease, vascular disturbance of the femoral head, trauma, and many other reasons have been cited to be responsible for epiphyseolysis of the femoral head. Children usually between the ages of 10 and 13 are affected by this condition. Obesity is very often observed in these patients. There may or may not be a history of trauma. In the beginning there is mild pain on walking and a slight limp which occurs intermittently. Gradually these symptoms become worse and continuous.

On physical examination the patient appears to walk with a slight limp and keeps his affected leg in outward rotation. The extension and outward rotation of the hip joint usually is normal. Often a slight flexion contracture is observed. Inward rotation is very definitely and always restricted.

The x-ray examination reveals that the femoral head had slipped downward, backward, and inward, but remained intimately attached to the femoral neck. Normally the head projects a little beyond the superior border of the neck and forms a "shoulder." This projection is usually reduced or completely obliterated. The epiphyseal plate, normally from 1/16 to 1/8 inch thick in its vertical diameter, is 1/4 inch thick and irregular in its appearance. The neck appears shorter and wider because of its relative anteversion. The bone in the immediate surrounding of the epiphyseal plate shows rarefication or/and sclerosis.

Once the diagnosis of incipient epiphyseolysis of the femoral head has been made the treatment should be instituted immediately. It is the author's contention that if the epiphyseal plate is made to fuse, further complications such as traumatic arthritis can be averted. There are several methods in use to accomplish fusion of the epiphyseal plate. The author, however, uses drilling as a means of fusing the femoral head to the neck.

The postoperative care consists of the application of a plaster hip spica which is left on for 3 months. During this time the patient stays in bed. He returns to the hospital at the end of this period at which time a roentgenogram is taken. The epiphyseal plate is, as a rule, found to be thinner and shows partial absorption. Another plaster of Paris spica is applied and left on for an additional 3 months. The hip spica extends to the middle of the leg and walking with crutches is allowed. Three months later another roentgenogram is taken. At this time the epiphyseal plate usually is very thin and the juxtaepiphyseal sclerosis has disappeared. The patient is given a Thomas leg brace with an ischial seat bearing. This brace is worn for an additional 6 months or longer until the roentgenogram shows complete fusion of the femoral head and neck. By the use of physical therapy the knee and ankle are kept mobilized during the latter period of treatment.

In conclusion the author presents 4 cases with the corresponding roentgenograms and mentions the fact that he has treated 12 additional cases in the same manner with very satisfactory end-results.

GEORGE I. REISS, M.D.

Brachetto-Brian, D.: The Origin and Evolutionary Cycle of Giant Cells of Tumors of the Bone, Benign Variety. Preliminary Communication (Origen y ciclo evolutivo de la mieloplaxa de los tumores de los huesos, var. benigna. Comunicacíon previa). *Arch. Soc. argent. anat.*, 1944, 6: 515.

While studying a hemorrhagic zone in a giant cell tumor from the upper epiphysis of the humerus, the author discovered a certain syncitial cell having a large nucleus, one or two nucleoli, basochromatic reticulum, and a basophilic cytoplasm. Mitosis was observed, and also an amitosis prior to the division of the nucleus and formation of daughter cells. The latter were termed juvenile myeloplaxa or myeloplaxacito because the nucleus was much the same as the nucleus of the syncitium.

The evolutionary cycle of these cells was studied under the headings of (1) origin and growth; (2) adult form; (3) old age, and (4) death. In the first (myeloplaxacito I) the cells contained from 4 to 10 nuclei. Direct division was frequently observed as was the independence of the cytoplasm. In the second class (myeloplaxacito II) augmentation of the basophilic cytoplasm prior to fission and phagocytosis were seen. In these cells the nuclei may total 100. In the old age class (myeloplaxacito III) the nuclear volume decreased, the ovoid shape of the nucleus changed to an irregular polyhedron, the basochromatin became condensed, nucleoli were no longer visible, and pyknosis was present.

The architecture as well as the osteolytic character of blastomas becomes clarified if the evolution of blastoma as outlined is accepted. The intervention of the giant cells in the softening of the fundamental substance of blastomas is understandable; the alteration that occurs and the contribution to the breaking-down phenomenon and epiphyseal distention have a basis in fact in the light of the evolutionary cycle of giant cells as discussed in this article.

STEPHEN A. ZIEMAN, M.D.

Marique, P.: Polycystic Xanthoma of the Meniscus (Xanthome méniscal polykystique). *Acta. orthop. belg.*, 1946, 12: 121.

Pathological conditions of the menisci of the knee are chiefly traumatic ruptures. Congenital malformations and cysts are less frequent and tumors are rare.

The author describes a case of polycystic xanthoma of the external meniscus of the left knee in a woman of 35; cysts are twice as frequent in males as in females. She had suffered a blow on the left knee some years before and the tumor had developed gradually, accompanied by pain. Examination showed a tumor the size of a filbert in the middle of the external interline; it was quite hard and protruded much more on extension than on flexion. It did not interfere greatly with movement. There was considerable atrophy of the muscles of the thigh.

Operation was performed under spinal anesthesia and the meniscus was extirpated completely. The wound healed by first intention; a plaster cast was applied and kept on for 15 days. When it was removed the joint was rigid but flexion to 90 degrees was recovered in 2 months and complete flexion of the heel against the thigh in 3 more months.

Illustrations are given showing the gross and microscopic appearance of the specimen. The solid tumor which was the size of a cherry was in the central part of the specimen and was surrounded by a large cyst and a number of smaller ones. The abundant fatty matter in the tumor was shown to be made up of cholesterin esters. The xanthomatous nature of the tumor was further demonstrated by a positive Liebermann reaction.

Polycystic tumors affect the external meniscus in 80 to 85 per cent of the cases; they are generally multilocular with a mucus content. Several cases of xanthomatous deposits associated with such cysts have been described. They generally show a rich hemosiderin content, many polynuclear giant cells, xanthomatous cells, and lobulation. The described case differed from this typical picture in not showing giant cells or hemosiderin pigment. Henschen explains these xanthomatous deposits as being due to an "arthrotropic cholesterinophilia."

AUDREY G. MORGAN, M.D.

Lerner, H. H., and Gazin, A. I.: Interarticular Isthmus Hiatus (Spondylolysis). *Radiology*, 1946, 46: 573.

The authors believe that interarticular isthmus hiatus is probably the result of a hyperflexion injury or fracture through the cartilaginous isthmus sustained either at birth or shortly thereafter. The literature, embryology, and anatomy are carefully reviewed.

In 1853, Kilian first described the entity "spondylolisthesis," of Greek derivation meaning slipping of a vertebra. Neugebauer (1892) is to be given credit for the widespread recognition of this condition. Much has been written on this subject by Willis, Mall, Batts, Hitchcock, Chandler, Meyerding, Kleinberg, and others.

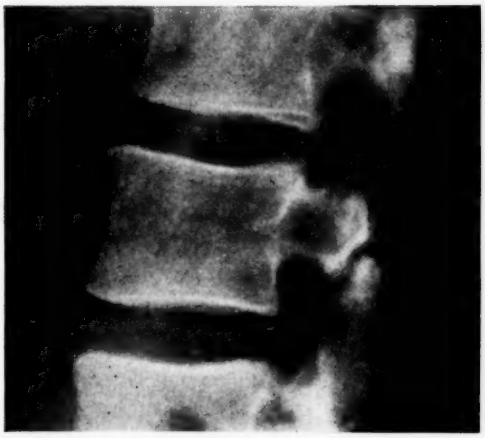


Fig. 1. (Lerner, H. H., and Gazin, A. I.) Lateral view: isthmus hiatus of third lumbar vertebra.

The diagnosis of interarticular hiatus, with or without slipping, is based upon the roentgen findings, of which there are 5:

1. Demonstration of the hiatus
2. Underdevelopment of the vertebral body
3. Displacement of the vertebra in relation to the adjacent segments
4. Increased total anteroposterior diameter of the vertebra
5. Buttress formation at the anterior lip of the sacrum when the fifth lumbar vertebra slips.

DANIEL H. LEVINTHAL, M.D.

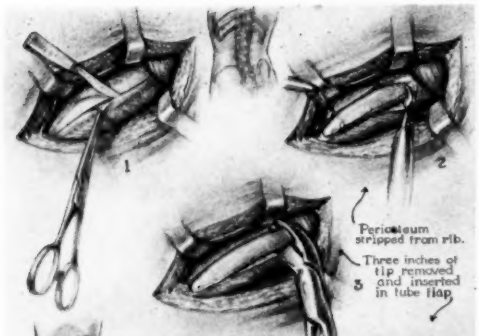
SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Greeley, P. W.: Reconstruction of the Thumb. *Ann. Surg.*, 1946, 124: 60.

Thirteen cases of reconstruction of the thumb provide the material for this article. The operation for deepening the web between the existing thumb stump and the adjacent metacarpal was done on 3 patients.

Pollicization of a remaining partial finger was not done in this series nor was transplantation of a toe considered desirable.

Ten cases were treated by lengthening the existing thumb stump. The procedure consists in constructing first a tubed pedicle flap of skin and fat from a hairless area on the flank (Fig. 1). This is attached to the thumb stump when circulation from the abdominal end is known to be adequate. Later, when the circulation from the thumb attachment is known to be adequate, the abdominal attachment is severed and the tube splinted to prevent strangulation. This new thumb is allowed to become well softened in its new position, and then it is made rigid by inserting a perforated bone graft, obtained from the twelfth rib,



a

b

Fig. 1. (Greeley). a, Explains the operative technique for removing the twelfth rib. In this case the bone graft was placed first into the tubed pedicle while it was still attached to the abdomen at each end. b, Later the distal end of the tube was attached to the thumb stump and at the same time the base of the bone graft was swadged into the metacarpal. This order of procedure has been abolished because of the difficulty in holding the hand in position without accidentally pulling the bone graft out from its new bed. c and d, Illustration of the case involved. e, Shows the roentgenogram of the bone graft 16 months after transplantation. Good bony union is noted. (This patient had suffered a greenstick fracture at the base 3 months before—the injury occurred during basketball play.) The patient plans to return to a civil occupation as a mathematics instructor in a University. The authors feel confident that the restoration will enable him to hold a piece of chalk. (Courtesy of J. B. Lippincott Co.)

c d e

into the core of the tube and fixing its proximal end into a hole drilled into the medullary cavity of the remaining portion of the first metacarpal bone. About 6 months is required for complete bone healing and splinting is continued during this period.

A troublesome complication, noted 8 times, was gangrene of the tip of the tube, which appeared from 10 to 18 days after the abdominal attachment was severed. It required excision of the resulting ulcer.

In 2 cases, infection and necrosis of the bone graft occurred. The graft had to be removed and later replaced from the remaining twelfth rib. Accidental fracture occurred in 1 patient who played water basketball before healing was complete. The graft healed in approximately 2 months.

The photographs which illustrate this article show that a thumb, satisfactory from both the cosmetic and functional view points, can be produced by this method, but phalangeal joint activity is not provided. There is sufficient range of motion at the metacarpocarpal joint to allow for good opposition against the remaining fingers. NEWTON C. MEAD, M.D.

Kallio, K. E.: Plastic Operations on the Thumb (Sur les opérations plastiques du pouce). *Acta chir. scand.*, 1946, 93: 231.

In spite of the disability and inconvenience caused by the absence of a thumb, a review of the literature does not impress one that much attention has been given to plastic procedures for surgical correction. Most surgeons have an experience covering only 1 or at most 2 or 3 cases. The author presents a series of 10 cases which he divides into two groups, according to whether the material for plastic replacement was taken from the immediate adjacent tissues of the hand, or transplanted from other parts of the body.

Huguier, in 1852, was the first to practice phalangization of the first metacarpal. This operation involves an incision of the skin fold of the thumb extending dorsally along the arched skin fold at the thenar base thus forming a cutaneous dorsal and volar flap. The first interosseous muscle and the transverse head of the adductor muscle of the thumb are removed. The dorsal cutaneous flap is sutured into the base of the palm and the volar flap to the dorsum of the hand. In 1938, Koester reported 3 cases operated upon by this method and collected 45 similar cases from the literature. The results were unsuccessful in only 2 of the 38 cases in which results were stated. In his opinion this operation constitutes the easiest and most rapid method of producing a thumb with sensibility, mobility and power. If one or two other digits besides the thumb were missing, Perthes found phalangization could be rendered more satisfactory by removal of the second metacarpal, or if only the metacarpals remained, as much of the second and third metacarpals as necessary were removed to provide a broader cleft. Schossener, however, removes only the second in either event. Lukscha, in 1903, described an operation in which a finger of the same hand was transplanted to take the place of the thumb. Buzello transplanted the index finger and a portion of the second metacarpal. Iselin also reported successful results by this method in 3 cases. Meyer proceeded in this manner to replace a missing thumb by the midfinger. The disadvantage of these methods is that the hand, already disfigured, has to be further damaged with sacrifice of otherwise normal digits and the creation of further cicatrices. In a case in which the thumb and index finger were absent, and the remaining fingers had been amputated, Spitzy and Jenner removed the proximal portion of the second metacarpal, transplanting it as an elongation of the distal end of the second metacarpal. In the present series 2 cases were treated by simple phalangization. In the first of these, in which only the little finger remained intact with very little of the first phalanges of the thumb and index finger, phalangization seemed definitely indicated. In the other case, in which only the thumb was defective and the rest of the hand normal, the first interosseous muscle and the greater portion of the adductor muscle were likewise removed. The new thumb presented good power of adduction. With this incision it was possible to close the defect without undue tension on the skin. A strong, sensitive thumb was obtained in both cases with perfect mobility, even though in one the thumb was rather short due to the length of the metacarpal. In 2 cases, the author performed a phalangization of the first metacarpal, removing the second metacarpal according to Perthes, with excellent results.

Nicoladini's first method of correcting defects of the thumb by transplantation of grafts from other body parts consisted of the formation in one or two stages of a tubular skin flap containing bone, producing a thumb by uniting it with the first metacarpal. His own attempts did not yield successful results but later writers obtained good results with flaps taken from the abdomen or chest and bone from the tibia, fibula, rib, clavicle, metacarpus, or iliac crest. This method was used in 5 cases in the present series. The transplanted bone in the skin tube was absorbed in 4 cases, necessitating repeated bone transplantation and loss of time. The thumbs thus produced were most satisfactory as regards sensibility, mobility, and strength. All of these thumbs were sensitive to touch and pin prick except at the ends, and four were even sensitive to heat.

In 1 case in which the thumb and first metacarpal were missing, excellent results were obtained by a distant plastic performed in three stages. In the second stage a free bone graft was inserted directly into the multangulum majus and, after fixation, it was introduced into a skin tube formed from abdominal skin at the first stage, and simultaneously this tube was then sutured to the hand. This method replaces Nicoladini's first method which should be abandoned.

It is suggested that in estimating disability for compensation claims, this should be judged as between 10 and 15 per cent higher when the first metacarpal is missing. Plastic operations are capable of reducing this disability from 5 to 10 per cent.

EDITH SCHANCHE MOORE

Haggart, G. E., and Hare, H. F.: Combined Roentgen Radiation and Surgical Treatment of Large Benign Giant Cell Tumors of Bone. *Ann. Surg.*, 1946, 124: 228.

The authors present the therapeutic technique and results obtained in the management of 7 patients with proved benign giant cell tumor of bone which presented difficult problems in treatment. The treatment consisted of roentgen radiation which was followed by surgical removal of the tumor with thorough curettage and filling of the defect with bone grafts. Neither chemical nor thermal cauterization was employed.

For those benign giant cell tumors of the bone which are readily accessible and can be removed without sacrifice of function, immediate and complete excision is recommended. Examples of such tumors are those observed in the vertebral spinous and transverse process. The preoperative radiation given is described; postoperative radiation was not given, except to 1 patient who had a 2 stage operation because of his extremely poor physical condition.

The operative process is described and the report of the 7 cases is given in detail with a summary of the results. In each instance the extremity was saved and there has been no evidence of recurrence of the tumor; the affected extremity is now a useful member. The roentgen radiation therapy did not interfere with the reparative process of the tissues following surgery. EMIL C. ROBITSHEK, M.D.

Altman, H., and Trott, R. H.: Muscle Transplantation for Paralysis of the Radial Nerve. *J. Bone Surg.*, 1946, 28: 440.

Among war injuries many compound fractures of the lower two-thirds of the humerus present an associated paralysis of the radial nerve. In cases of irreparable damage to the nerve, tendon transfer at the wrist has resulted in functional recovery of the hand and wrist in 2 or 3 months. The authors present 28 cases in which permanent radial or dorsal interosseous nerve lesions indicated tendon transplant.

The technique of Billington with the right angle incision on the extensor surface of the lower forearm employed in the early cases resulted in edema of the hand and slough in the angle of the incision. Modification of the approach reduced the trauma incident to the handling of the tendons, and enabled patients to become ambulatory in 48 hours.

In a few cases this procedure was carried out in addition to nerve repair. This makes the hand useful in a few weeks, and most efficiently supports the wrist during the period of nerve recovery.

The surgical technique is presented in detail; transverse incisions proximal to the dorsal carpal ligament are used for isolating the tendons. The pronator teres tendon is threaded through and sutured to the tendons of both radial extensors of the wrist. The tendon of the ulnar flexor of the wrist is similarly attached to the extensors of the index, middle, ring, and little fingers by the buttonhole technique of Mayer. The radial flexor of the wrist is likewise passed through and sutured to both extensors and the long abductor of the thumb.

The tension with which the tendons are transplanted approximates the physiological as closely as possible. A plaster splint is applied to maintain the fingers in extension and the hand in 30 degrees of dorsiflexion.

The pronator teres transplant is not needed if the lesion involves the dorsal interosseous nerve. The arm is elevated from 1 to 2 days after operation, when the patient is allowed up with the arm in a sling if the edema is gone. Fingertip motion on the splint, is begun at once, and after the sutures are removed at the beginning of the fourth week, gradual active use of the transplants is begun. The splint is worn only at night during the fifth week, and discarded at the sixth week.

Good results were obtained in all cases, each patient leaving the hospital with a functioning hand that had a strong grip. Complete extension and abduction of the thumb were secured in all cases, with complete extension at all interphalangeal joints and extension to within 15 degrees of normal at the metacarpophalangeal joints of the other digits. Dorsiflexion at the wrist was possible to 25 degrees beyond neutral. FRANCES E. BRENNECKE, M.D.

FRACTURES AND DISLOCATIONS

Celoria, F.: Fractures of the Upper End of the Radius (Fracturas de la extremidad superior del radio). *Bol. Soc. cir. Rosario*, 1945, 12: 205.

This form of fracture is more common than is usually believed. Among 5,319 cases of trauma examined by the author from 1942 to 1945, 1,089 were fractures of the upper extremity and of these 40 were fractures of the upper end of the radius. Therefore, fracture of the upper end of the radius constitutes 3.6 per cent of all fractures of the arm. Of a total of 176 fractures of the elbow, 40 (22%) were of the upper end of the radius, while 43 (24%) were of the supracondylar region of the humerus.

In fracture of the upper end of the radius the external condyle of the humerus is frequently injured also; even if it is not fractured there are erosions of the cartilage which may later cause rigidity of the joint. All contused tissue should be removed by operation. The roentgenogram does not always show the extent of injury in these fractures.

Among the author's cases, 26 (65%) were incomplete fractures, 4 (10%) partial fractures, and 10 (25%) complete fractures. In the incomplete fractures the author immobilizes the part with a plaster cast for 2 or 3 weeks, followed by active mobilization and Bier's local hyperemia. He had good results in 88.8 per cent of these cases. In recent partial complete fractures he simply extirpates the fragments if two-thirds of the circumference of the head is intact. In total complete fractures he extirpates the whole head. He had satisfactory results in 87.5 per cent of the surgical cases.

A table of the 40 cases is given, showing the name, age, and sex of the patient, and the date and mechanism of the fracture. (In 44.4% of his cases the violence was direct while in 55.5% it was indirect. Most authors report a great majority of cases caused by indirect violence—a fall on the hand with the elbow generally extended but sometimes flexed.) The table also shows the variety of the fracture, the treatment, and the early and late results.

AUDREY G. MORGAN, M.D.

Nohrman, B. A.: Fractures of the Elbow with Particular Regard to the Distal End of the Humerus. *Acta radiol.*, Stockh., 1946, 27: 409.

A series of 324 persons with 328 fractures of the elbow were observed during the years from 1932 to 1941 and the follow-up examinations were carried out in 1943 and 1944. Sixty-one per cent of the fractures involved the distal end of the humerus. Forty-one per cent of the fractures were in adults and 59 per cent in children. Supracondylar fractures as well as fractures of the humerus are most common in children. Fifty-six per cent of the total were in males and 44 per cent in females. Forty-one per cent of the injuries involved the right arm and 59 per cent the left. Among the supracondylar fractures, 78 were of the extension type and 13 of the flexion variety. In those cases in which the reduction was satisfactory a very good result occurred.

The condyle and epicondyle fractures represented about one-third of the total material. Fractures of the epicondyle comprised about 50 per cent, of the lateral condyle 40 per cent, and of the medial condyle 10 per cent. Among 20 cases of epicondylar fracture reduced without surgical intervention, the position was not perfect and the bone healed in only 4 of these. Myositis ossificans was seen in 6 fractures of this group. RICHARD J. BENNETT, JR., M.D.

Pieri, G.: Management of Habitual Dislocation of the Shoulder (Sulla cura della lussazione abituale della spalla). *Chir. org. movim.*, 1943, 29: 134.

Existing methods of dealing with the problem of habitual dislocation of the shoulder are directed toward (1) the articulation, (2) the muscles and tendons, or (3) the skeleton. The author describes a method which consists essentially of suspension of the humeral head by means of a slip of the deltoid muscle which is passed through a tunnel from the front to the back and subsequently through an opening in the spine of the scapula. The muscle slip is then secured to the superior surface of the spine.

This method was used in 7 cases, 6 of which presented satisfactory results. One case only showed limitation in power of abduction, which was probably attributable to an extended period of postoperative immobilization.

EDITH B. FARNSWORTH, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Warren, R.: War Wounds of Arteries. *Arch. Surg.*, 1946, 53: 86.

The author presents a survey of 115 patients with arterial wounds, admitted to a general hospital from a few hours to 3 weeks after being wounded. The distribution of these injuries is as follows: carotid artery, 11; subclavian artery, 1; axillary and brachial arteries, 51; femoral artery, 18; profunda femoris, 4; and popliteal artery, 30.

The author's experience confirms the teaching that the injury to the internal carotid artery is more serious than that to the common carotid artery, so far as the resultant damage to cerebral tissue is concerned. The syndrome, with hemiplegia, no hematoma in the neck, fracture of the mandible, injury to the vagus nerve or its branches, injury to the cervical portion of the sympathetic system, clear spinal fluid, and normal roentgenograms of the cranial vault, suggests injury to the internal carotid artery. An injury to the common carotid artery is perhaps distinguished from this by the commoner occurrence of pulsating hematoma, Horner's syndrome, and injury to the vagus nerve, and by the comparative rarity of mandibular fractures and hemiplegia. The most striking features of these patients are neurologic signs of hemiplegia and aphasia. It is believed that the explanation of the findings in injuries of the internal carotid artery are on the basis of contusion and arterial spasm since all 4 patients in this group presented small penetrating or perforating wounds of the neck and little or no hematoma. In only 1 patient was there an indication for exploration, and this was due to severe secondary hemorrhage from the base of the tongue. A segment of internal carotid artery, 1 cm. in length and about 1 cm. distal to its origin, was found to be constricted to about 60 per cent of the normal caliber. The artery was thus transmitting less blood than usual and the author believes that the scar that has formed continues the condition of original spasm and accounts for the difficulty. This is difficult to understand.

Only one patient in this group was seen with concomitant brachial plexus injury. This proved to be an arterial lesion with an aneurysm 6 by 10 cm. in the second portion, which was excised, the accompanying vein ligated, and neurolysis of the brachial plexus done. This had been preceded by a dorsal sympathectomy 9 days previously for causalgia.

There were 41 injuries to the brachial arteries and 10 to the axillary arteries. All but one of the 41 patients had an associated nerve injury. Eleven patients were operated upon, with ligation of the artery in 9 and an endoaneurysmorrhaphy in 2 patients. The level of ligation in these younger subjects (either proximal or distal to the profunda brachii artery) was believed to be of no importance. The importance of adequate exposure and control of the artery proximally so that operation can be safely done, especially with regard to accidentally opening the aneurysm and then controlling the bleeding, is stressed. In the cases presented, the vessel was tied proximally, provisionally. A circular bandage, especially a cast, is considered dangerous in cases of arterial injury, particularly when the artery has been ligated, until the circulation has been stabilized. Varying degrees of causalgia were noted in these cases and, if persistent, was easily treated with dorsal sympathetic block or sympathectomy. Usually, however, removal of the aneurysm and neurolysis of the involved nerves was sufficient. The importance of physical therapy in the treatment of the involved extremity is stressed.

There were 18 patients with injuries of the femoral artery; of these, 8 arrived with amputation previously done. Experience with ligations of the common femoral artery has given the author great respect for this type of operation.

There were 30 patients with injuries to the popliteal artery. Of these, 22 had gangrene to such an extent that amputation was required in all but 1 patient. Four others had atrophy or ischemic myositis. Eleven of the 21 who had undergone amputation, had associated fractures. Of the 3 patients who underwent arterial operation, gangrene developed in 2, who later required amputation. Supracondylar fractures of the femur with contusion or rupture of the popliteal artery were present in 4 cases and amputation was done in all. The resulting circulatory damage was so severe that all but one required amputation above the knee. Of the 21 amputations for injury to the popliteal artery, 11 were performed above the knee joint and 10 below, with very short stumps resulting in 6. Two patients who had had incisions to relieve pressure on collateral vessels were more fortunate and obtained longer amputation stumps.

There were 13 patients in whom secondary hemorrhage was severe enough to require operative intervention, or cause death. These ligations were of the following arteries: common femoral, 1; superficial femoral, 1; deep femoral, 2; popliteal, 1; posterior tibial, 1; brachial, 1; external carotid and common carotid combined, 1; external carotid alone, 2; internal pudendal, 1; and right lumbar, 1. Special situations that occurred were: injury to a right lumbar vessel, traumatic aneurysm of the superior thyroid artery, injury to the left lingual artery, and aneurysm of the internal maxillary artery presenting below the inferior turbinate of the left naris.

The critical arteries are the popliteal, the internal carotid, and common femoral. Sympathectomy should be done, if possible, before or immediately after ligation of these critical arteries. If possible, sympathetic ganglion blocks should be used for 48

hours. The author strongly favors the Henle-Coenen test to determine the desirability of an anastomosis or venous graft. In all cases in which proper attention was paid to the presence of back bleeding from the distal segment, no difficulty ensued if this was obtained. This is not as valid in early stages in which there may be spasm and thrombosis in the collateral vessels. These elements are then evaluated with difficulty. LEROY J. KLEINSASSER, M.D.

Mustard, W. T.: The Technique of Immediate Restoration of Vascular Continuity after Arterial Wounds. *Ann. Surg.*, 1946, 124: 46.

When confronted with the problem of revascularizing the dangerously ischemic limb, one is at once impressed by the unsolved problems in anatomy, physiology, and pathology. It is, therefore, essential to define the extent of ischemia affecting the wounded extremity. The dangerously ischemic limb is one which has been deprived of its blood supply to such an extent that vital processes no longer take place and gangrene results. The forerunner of this state is ischemia, and whether the ischemia progresses to recovery or not depends upon the volume of blood the limb receives, the pressure at which it is delivered, the length of time the ischemic state has existed, and the metabolic demands of the limb itself. It is only by a consideration of the general condition of the patient, the time interval, and both the function and appearance of the limb that the degree of ischemia can be determined.

The variability of the circulation through the main and collateral channels renders dogmatic anatomic statements worthless. Even though the distal pulses are absent it is reasonably certain that a limb will survive if active movement of the digits is present and the digital skin has some warmth, some sensation, and is not of an unnatural color. If, however, active motion of the digits is no longer present and the digital skin is cold, insensitive, and of an unnatural color, then the limb is dangerously ischemic.

Active surgical interference is to be avoided when possible, if recovery of the limb is to be expected. In the dangerously ischemic limb, however, operation becomes a matter of some urgency whatever the local arterial lesion. In the absence of arterial spasm and of occlusion of the vessel by extravascular compression, the type of surgery is limited to ligation or some attempt at re-establishing the circulation.

Ligation of the main vessel removes the hazard of further bleeding but does little to improve the blood supply of the limb. Experience has shown us that it is the procedure of choice in certain circumstances, particularly: as a lifesaving measure, and if heparinization is impractical. The administration of heparin requires qualified supervision including careful nursing and repeated estimations of the clotting time; it is contraindicated in multiple wounds and in wounds involving the cranial, pleural, or abdominal cavities.

Ligation is also to be used if the limb has been avascular longer than 10 hours. The survival time of avascular tissue has been investigated by many observers and the general view (with which the author's opinion coincides) is that if warmth to the limb is avoided, skin will survive 24 hours, muscle, 6 to 10 hours, and nerve a shorter period.

If trauma has been extensive, ligation will be in order; however, experience with traumatic amputations and with crush injuries would lead one to believe that no attempt at revascularizing a crushed limb should be made until more is known of this pathological condition.

Ligation is also the procedure of choice in the upper extremity. The collateral circulation in the arm is rarely sufficiently damaged to warrant anastomosis of the main vessel.

Re-establishment of the circulation in the dangerously ischemic limb is a practical procedure and may be accomplished by any of the classical methods. The author discusses the procedure he uses, stressing the indications for the use of inert materials and the technique involved in placing the tube in the arteries. He also discusses the difference of technique in the operative procedure for anastomosis of the vessels, the technique in complete division, the technique in incomplete division and traumatic thrombosis, along with the postoperative care and the technique of secondary operations when they are indicated. He summarizes the data of 15 patients upon whom immediate restoration of vascular continuity was undertaken after they had acquired arterial wounds and gives the following summary of his experience:

In the dangerously ischemic limb, re-establishment of the circulation by artificial anastomosis is practical under conditions in which heparinization is possible. The technique of the operation is simple, but postoperative care is difficult. The operation has been performed 15 times with heparin; thrombosis does not occur in the tube if the clotting time is kept sufficiently elevated. Careful administration of this anticoagulant with repeated estimations of the clotting time is necessary to insure success. During the critical period, the blood loss must be carefully considered, and the blood pressure must be maintained by repeated transfusions of whole blood. The limb must be elevated to prevent muscle edema; warming of the limb is to be avoided and care must be taken with dressings. The tube may be left safely in the vessel up to 6 days. The second stage of venous graft has been performed 6 times, the nonsuture method twice, and the suture method 4 times. Other factors being equal, the success of the graft is in inverse proportion to its length. Following venous transplantation, heparinization should be continued for at least 4 days.

A rigid tube is preferable to a venous graft as a temporary arterial bridge in acute ischemia of the limb. The results of this type of anastomosis have not been impressive and success has been an unusual achievement in war surgery in the Forward Area. It is, however, only a beginning in a new field and its application to elective arterial surgery may be of some importance. PAUL MERRELL, M.D.

Servelle, M.: Thrombosis of the Iliac Arteries and Bifurcation of the Aorta (A propos des thromboses arteritiques des iliaques et du carrefour aortique). *Rev. chir., Par.*, 1946, 65: 227.

The treatment of arteritis comprises two procedures: (1) resection of the thrombosed segment which serves as a source of vasoconstricting reflexes, and (2) section of the sympathetic lumbar chain, supplemented, if necessary, by splanchnicectomy or left suprarenalectomy.

In the first series (3 observations) the author performed only sympathectomy, with or without splanchnicectomy. In each instance a secondary arteriectomy of the involved iliac artery was required. The first stage of the operation was not followed by great relief and the patients had to submit to a second operation.

Therefore, in the second series (4 cases) the author performed iliac arteriectomy and complete lumbar sympathectomy in one stage. All 4 patients stood the operation well.

The author points out that sympathectomy is indicated in arteritis only if a thrombosed segment can be located.

As to the technique, the author advocates the so-called progressive section suture. The first 4 lumbar ganglia are removed.

Obliteration of the external, or the common iliac, artery does not give as grave a prognosis as the obliteration of the femoral, popliteal, or posterior tibial artery.

JOSEPH K. NARAT, M.D.

Catalano, G.: Intra-arterial Injections in the Treatment of Endarteritis Obliterans (Le iniezioni intra-arteriose nel trattamento dell'endoarterite obliterante). *Ann. ital. chir.*, 1946, 23 : 1.

Because intra-arterial medication has a direct action on the sympathetics, the author advocates its use in endarteritis obliterans. In a study of 7 patients, 4 of whom had received an intra-arterial mixture of acetylcholine and padutin, while the remaining patients were treated with intra-arterial nicotinic acid, favorable results were obtained in all cases. Not only was there a disappearance of pain in the part involved, but there was a rapid appearance of a line of demarcation in gangrenous cases. Rapid healing following removal of the gangrenous parts, and an increase of cutaneous temperature, confirm the beneficial effect derived from this form of treatment. This intra-arterial therapy is better tolerated than treatment by the subcutaneous or intravenous route and there are no contraindications.

In the acute crisis of endarteritis obliterans, gangrene can be prevented by the arterial injection of acetylcholine, padutin, and nicotinic acid, and if gangrene is present it will be arrested with evidence of a line of demarcation.

The technique is simple. After finding the pulsation of the femoral artery, a fine needle attached to a 10 c.c. syringe is inserted through the skin, 1 to 2 cm. below the arch of the femoral vein. The femoral vein is entered after the pulsation of the vessel on the needle is felt and the solution is injected slowly. The patient experiences a severe burning pain, and an intense vasodilatation with a rise of skin temperature, first up to the knee then down the leg.

With the intra-arterial injection of nicotinic acid no pain is felt; however, in the 3 patients so treated, hyperemia was not evident. Although there was an increased pulse rate for a few minutes, the fall in blood pressure was not great. The author cannot evaluate which of the two treatments is better, and he therefore advocates a combination of the two, giving daily injections for the first 5 days, followed by 10 more injections given on alternate days.

ARTHUR F. CIPOLLA, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

King, L. S., and Myers, Hu C.: Use of Routine Bed Exercises following Major Surgery. *South. Surgeon*, 1946, 12:36.

Up to the year 1939 little effort was expended toward the prevention of postoperative complications due to bed rest. Turning patients or changing their position in bed were the only routine measures employed. During 1939 one of the authors attended a series of lectures by R. Watson Jones of England. Mr. Jones stressed to each patient the need for active exercise of all available joints and muscles, and the author noted that the patients of Jones had less osteoporosis, joint stiffness, and adhesions, and better muscle tonus and morale than the average patient immobilized in plaster.

The following routine was then begun in all patients with casts, and was used later, with slight changes, as a routine procedure in all surgical cases:

The patient should (1) turn himself in bed each hour immediately following reaction from anesthesia; (2) take twelve deep breaths, filling the lungs completely every 3 hours; and (3) exercise actively and vigorously every joint of the extremities for 5 minutes every hour. (This was accomplished by active flexion and extension of the hips, knees, ankles, and toes; adduction and abduction of the shoulders; flexion and extension of the elbows; pronation and supination of the forearms; and flexion and extension of the wrists and fingers.)

Much time and effort must be expended in repeatedly instructing patients in these routines, as simply writing orders for exercise or routinely instructing the patient to take exercises is inadequate.

Nurses must be admonished to see that all patients carry out the exercises in a satisfactory manner. The surgeon must, by repetition, demonstration, and insistence again and again impress each patient with the necessity for complying religiously with these orders. Some patients fail to co-operate in spite of all these measures.

The authors believe that patients who adhere to this régime faithfully convalesce rapidly. In many patients the results are intangible; there may be an improved sense of well being, improved morale, more apparent resistance to disease, and a greater determination to recover.

The authors review their series of 1,476 major operations on 1,009 patients from January 1, 1939 to January 1, 1946. For comparison they reviewed 150 major operations performed on 123 patients from January 1, 1938 to January 1, 1939. There were 2 cases of postoperative thrombophlebitis among the 123 cases in 1938, an incidence of 1.6 per cent. There were 8 cases, an incidence of 0.79 per cent (a decrease of nearly 50 per cent) among those operated upon from 1939 to 1946. Two of the 8 could not be persuaded to exercise properly.

One case of wound disruption occurred in 1938, an incidence of 0.81 per cent. There were 5 cases in the second group, an incidence of 0.48 per cent. In none of these cases could the active exercise be held responsible for the disruption.

Six cases of pulmonary complication (4.8%) occurred during 1938 and 16 cases (1.5%) during the subsequent period, a decrease of 69 per cent. The end result was fatal in one-half of the patients operated upon during 1938 and in one-fourth of those operated upon in the second period.

One case of hemorrhage was found in 1938, and 6 cases in the later series—a decrease in incidence from 0.81 to 0.59 per cent. In no case was there any evidence that postoperative exercises caused hemorrhage.

Wound hematomas were not numerous enough to be significant. There were 30 deaths in the entire series of 1,132 patients operated on consecutively from January 1, 1938 to January 1, 1946. Twenty-six autopsies were done and in no case was the death attributable to exercises in bed. For the 1938 series the death rate was 4.8 per cent, and for the later series, 3.3 per cent, with an overall mortality of 2.6 per cent.

The authors review some of the literature and stress the value of early ambulation and exercises in bed.

The reports of most authors were very favorable to early postoperative activity with certain exceptions in which a note of conservatism was expressed. The experiences of those who have followed the treatment of early ambulation or bed exercises have been very satisfactory.

The authors believe that early postoperative activity is justified by the increased rate of venous and lymphatic return, accelerated wound healing, lessened pulmonary complications, and improved patient morale.

The degree of activity must depend on a number of things including the gravity of the operation, the suture material used, the presence of local infection or ischemia of the tissues, and upon the judgment of the surgeon.

The authors are still carefully selecting their cases for early ambulation. However, they believe that definite benefits are to be had from postoperative bed exercises alone, and that they may be practiced as outlined in almost every case without regard to suture material used or the severity or type of operation.

ROBERT R. BIGELOW, M.D.

Spence, H. Y., Evans, E. I., and Forbes, J. C.: The Influence of a Special High Protein Diet on Protein Regeneration in the Surgical Patient. *Ann. Surg.*, 1946, 124: 131.

A negative nitrogen balance usually occurs postoperatively. This is correlated with loss of weight,

prolonged wound healing, and extended convalescence. A positive nitrogen balance unquestionably can be instituted in these patients by the use of intravenous substances such as amino acid mixtures, plasma, and whole blood. Most of the work on protein replacement therapy has centered around the substances which can be given intravenously. The authors have attempted to shift the emphasis to a diet that can be given orally and to determine the value of inexpensive protein material which can be made readily available to surgical patients. In spite of the controversy over whether administered protein is assimilated during the catabolic phase following traumatic injury or surgical operation, these diets were supplied soon after surgical operation.

Nine suitable surgical patients were considered in this report, and the dietary period was started from the third to the twentieth postoperative day. Clinical summaries of several illustrative cases are given.

The diet was made up of 150 gm. of dehydrated beef and liver protein mixture, 150 gm. of powdered whole milk, 50 gm. of corn oil, 150 gm. of dextrimaltose, 35 gm. of chocolate, and 1,000 c.c. of water (plus vitamins A, B, C, and D, and iron). This allowed a total intake of 3,000 calories each 24 hour period. The diet was given in liquid form with the insoluble material in fine suspension. Several patients had to be tube-fed for the first few days. Frequent feedings during each 24 hour period were employed. Blood plasma protein determinations were carried out at the beginning, after from 3 to 4 days, and at the end of each period. The nitrogen intake could be calculated from the volume of diet administered. Daily urine and fecal nitrogen were determined, and the nitrogen balance was calculated. Total circulating plasma and protein hemoglobin were estimated from the blood volume. Each patient was studied at least 7 days.

Nitrogen retention was good in all cases and averaged, in some subjects, over one-third of the nitrogen intake. Positive nitrogen balance was established in all patients studied. In cases in which malnourishment and anemia were prominent, hemoglobin, plasma protein, and tissue protein formation paralleled the results of Robscheitt-Robbins with hypoproteinemic dogs; that is, for every gram of plasma protein formed, 2 to 4 gm. of hemoglobin and 10 to 30 gm. of tissue protein were formed. Well nourished patients in whom blood loss was prominent used a greater percentage of the retained nitrogen for plasma protein and hemoglobin formation. Protein regeneration tended to be more marked in the tissues in which competition was greatest for the available amino acids.

Blood regeneration in cases in which acute infection was present revealed suppression of hemoglobin formation even to the extent of hemoglobin loss, and even though nitrogen retention was quite satisfactory. Plasma albumin and globulin regeneration was variable although it tended to be suppressed. Some cases, however, manifested accelerated plasma globulin formation in the presence of infection.

The authors' results in relation to plasma protein concentration and plasma volume are in accord with those of Lyons, Madden, Whipple, and others. Little correlation could be established between plasma protein concentrations and plasma volume, and in turn, total circulating plasma protein. Plasma protein and hemoglobin determinations per se do not reflect plasma protein and hemoglobin regeneration. Both values tend to show the same directional shift, but much variation is apparent.

The authors believe that it is feasible to administer a high protein, high caloric, high vitamin diet in liquid form in selected postoperative patients. This type of diet is well utilized and probably could be used to advantage in some cases in which more expensive modes of nitrogen intake are contemplated. The ease in determining the protein intake of this uniform liquid diet facilitates nitrogen balance studies.

ROBERT R. BIGELOW, M.D.

Annersten, S., and Norinder, E.: Postoperative Blood Changes with Regard to Shock. *Acta chir. scand.*, 1946, 94: 320.

Eight varieties of blood tests were performed routinely during the first 3 postoperative days in a series of 73 patients subjected to one of the following types of surgery: gastric, gall bladder, thyroid, thoracoplastic, breast, renal, laparotomy, or minor surgical repair. The purpose of this investigation was to find any changes in the blood which might serve as an indicator of shock. The blood tests were serum CO_2, serum Cl, total base, serum protein, serum potassium, serum lactic acid, hematocrit, and blood sugar. Except for statistical elevations of lactic acid and sugar, the other postoperative tests showed no significant change. The rise in blood lactic acid appeared to be directly proportional to the degree of tissue laceration caused by the operation.

In 2 cases resulting in death, the values of serum lactic acid were very high, indicating a relationship of the latter to shock. The postoperative increase in blood sugar was described as a reaction of the sympathoadrenal system, and hence involved in the early compensatory mechanism of shock.

Because hematocrit and serum protein showed insignificant variation, the authors believed that the increase in capillary permeability and the fall in serum protein were phenomena of the late phases of shock. Surgical operations failed to cause changes in the cation content of the blood, and cannot be relied upon to predict the onset of shock. Depletion of alkali reserve was not observed in any case. Neither did the postoperative acidosis parallel the increase in lactic acid, which proves that the latter was a factor of minor importance in early shock.

BENJAMIN G. P. SHAFIROFF, M.D.

Davis, J. S.: Present Evaluation of the Merits of the Z-Plastic Operation. *Plast. Reconstr. Surg.*, 1946, 1:26.

The author sums up in a general way his personal experience with the Z-plasty. The ideal place for a

Z-plastic is in those instances in which the skin is of normal texture, cases in which a web exists, in certain cases of partial syndactylism, and sometimes cases in which congenital grooves appear around the fingers, arms, toes, and legs. In the vast majority of cases, however, the Z-plastic operation is used to correct the scar contracture deformity which occurs for the most part as the result of healed burns.

The preliminary preparation includes, first, an adequate evaluation of the general physical condition. The author states that a great many of these scar contractures are operated on much too early and the failure of the Z-plastic results from the inopportune selection of time rather than from an inherent fault in the procedure. Local infiltration lowers local resistance to infection, interferes with circulation, and retards healing.

The operative procedure includes, first, marking out the lines of incision, and attempting in so far as possible to create a 60 degree angle between the central and arm lines of the Z. An angle of 20 degrees can be used and the selection of this angle should depend, in part at least, on the elasticity of the scar infiltrating the surrounding skin, on the thickness of the flaps, on the location of the contraction, and the contour of the part.

After the incisions are made and the flaps are mobilized and the underlying scars excised, the bleeding is carefully controlled. The flaps are then shifted and sutured. A pressure dressing is applied. This includes 3 per cent xeroform ointment covered by dry gauze and a sterile seasponge, some waste, and elastic adhesive plaster, in addition to a soft bandage. The loose stitches are removed on the third or fourth day and the remainder are removed by the tenth day. Massage is started after 3 weeks and continued for several months.

A Z-plastic may sometimes be used in series rather than singly. They can be used individually or they can be connected one with the other. The author believes that multiple Z-plastics are being used much less frequently than they should be. Occasionally after a period of 6 months, when the tissues have been softened and the circulation improved by massage, the same area can be further relaxed by a similar procedure. This is particularly useful in growing children.

Some of the advantages of this procedure are that it is simpler than other methods; in certain cases tissues are successfully utilized which would otherwise be discarded; the appearance compares favorably with other types of reconstruction; additional scarring of unscarred areas is avoided; and contractures can be permanently relieved.

LOUIS T. BYARS, M.D.

Zilliacus, H.; The Results of 5 Years' Treatment of Thrombosis and Pulmonary Embolism at a Series of Swedish Hospitals during the Years 1940 to 1945. *Acta med. scand.*, 1946, *supp.* 171, p. 13.

The author studied the problem of thromboembolism in Sweden by critical analysis of the hospital records of 14 institutions and by personal follow up of 765 cases traced from the charts. The material embraced the years from 1940 through 1944, the era of heparin and dicumarol therapy, and was compared against that of the earlier years of conservative therapy and bed rest.

The incidence of thromboembolism in these years was from 0.37 to 0.51 per cent among all types of cases. Compared with the earlier statistics, the latter incidence was less by almost one-half. However, the death rate from pulmonary embolism determined on a basis of the total number of thromboembolic patients has remained rather stationary. Most of the cases of pulmonary embolism occurred in thrombotic patients who were treated only by conservative therapy. Cases of pulmonary embolism occurred rarely in patients receiving heparin and/or dicumarol therapy. Since 1941, the mortality rate from thromboembolism in Swedish surgery was reduced to 1 per 1,000 and in obstetrics and gynecology to 0.1 per 1,000 patients.

The number of patients with thrombosis in the lower leg only and the number in whom the disease process progressed to the thigh were dependent on the type of therapy. Five of every 6 patients given conservative therapy suffered extension of the disease into the thigh, whereas in those who were given specific therapy the process was confined to the leg in every second case. Further, as a result of heparin therapy disappearance of the acute thrombotic symptoms was rapid as compared with the average of 21 days of elevated temperature in patients who were treated conservatively. Spread of the thrombosis to the other leg occurred in 30 per cent of the patients treated conservatively, while in those given specific therapy the incidence of spread was only 1.4 per cent. The complication of pulmonary embolism was 15 times more frequent in the conservatively treated cases and 9 of every 100 patients died, whereas only 1 of every 200 thrombotic patients given specific therapy died.

Sudden pulmonary embolism without signs of thrombosis was noted in 282 cases. In 114 of the latter, thrombosis was not diagnosed clinically until the embolism occurred. On postmortem examination of 60 of these cases, fresh thrombi in the deep veins of the lower extremity were found. It was the author's contention that the latter fatalities could have been avoided by daily careful examination of the lower extremities and the early institution of specific therapy. Among 103 patients with sudden pulmonary embolism treated with heparin and dicumarol, no deaths resulted, and only 11 were found to have any swelling of the legs as a postthrombotic sequela. In another series of 65 cases of pulmonary embolism treated conservatively, there were 21 deaths following repeated attacks of embolism. Hence, every patient with pulmonary embolism should be immediately heparinized in order to prevent the reformation of a thrombus at the site of first dislodgment and to counteract the growth of the embolus.

In the follow up study of patients who had recovered from deep vein thrombosis the sequelae after thromboembolism were classified as follows: (1) no signs or symptoms, (2) subjective symptoms only—tenderness, an aching pain, cramps, heaviness, (3) signs and symptoms after exertion—swelling, discoloration, (4) chronic swelling of the lower leg or some part of it, (5) chronic discoloration, eczema, or varicose veins, (6) leg ulcers, (7) swelling of the thigh after exertion, and (8) chronic swelling of the thigh.

The sequelae were much worse in the cases in which the thrombosis had extended to the thigh than in those in which it was restricted to the leg. Anticoagulant therapy was twice as favorable from the standpoint of sequelae as conservative therapy. In the cases receiving the latter, symptoms developed rapidly within a year after the acute attack. The majority of these patients were found to be in classes 4, 5, and 6, suffering from chronic swelling, discoloration, varicose eczema, and leg ulcers. The average classification in the 184 cases treated conservatively 1 to 5 years after recovery was class 5. The sequelae in patients with deep vein thrombosis of both the leg and calf were equally severe with many in class 5. The post-thrombotic sequelae in patients with involvement of the calf or leg treated with heparin were mild and more than half were in class 1.

Chronic swelling, discoloration, varicose veins, and ulcer must be regarded as a direct continuation of the disease process after subsidence of the acute thrombotic process. During the latter period a thrombus originates in one of the small veins of the calf and then expands in the direction of the blood stream. From venographic observations it is known that the small vein thrombi continue to grow and extend into larger veins until they finally fill these veins. The only 3 large deep veins in the lower leg, the anterior tibial vein, the posterior tibial vein, and the peroneal vein, flow into the popliteal vein which continues on into the thigh as the femoral vein and is the only deep vessel of the thigh. When the thrombotic process has involved the popliteal vein, stagnation occurs as the result of the obstruction of the remaining deep veins. Thereafter the superficial venous system must compensate for the return venous flow. This added burden on the superficial veins accounts for the discoloration, edema, and varicosities and depends upon the degree of involvement of the popliteal and femoral veins.

It is the author's belief that the surgical treatment of deep venous thrombosis by vein ligation, femoral, iliac or inferior vena cava, is less satisfactory than by treatment with anticoagulants. The only advantage that operation offers is an elimination of the risk of pulmonary embolism. The same risk can be eliminated also by means of heparin. Furthermore, heparinization has an added advantage because of its action on clinically undiagnosed thrombi. Finally, postoperative sequelae result from the ligation of a main stem vessel and this can be avoided by means of the use of heparin.

A detailed report was made of the cases of deep venous thrombosis at the Mariestad Hospital in Sweden during the period from January 10, 1940 to September 9, 1945. Of 16,495 patients admitted 209 developed venous thrombosis and pulmonary embolism. Diagnosis in every case was confirmed by venography and treated immediately with heparin. The latter series was compared with 264 cases of deep vein thrombosis at the same institution seen from 1929 to 1938 when conservative therapy was in vogue. It was found that 18 per cent of the conservatively treated patients died whereas only 1.4 per cent of the heparin treated patients died; thus the mortality rate from pulmonary embolism was one-tenth as large when specific therapy was given. The average number of hospital days in bed with conservative treatment was 40, while with specific therapy it was 4.7 days. Follow up examination revealed that 60 of the 76 heparin treated patients recovered completely without any sequelae. It was also noted that when heparin therapy was started upon early diagnosis the disease was limited to the lower leg, spread was prevented, and pulmonary embolism and thrombotic sequelae were avoided.

For the early diagnosis of thrombosis it must be remembered that the disease process begins in one of the following areas: the lower leg, calf, the plantar surface of the foot, the adductor region of the thigh, or the pelvic veins. The physician should not wait for an elevation of temperature but should always take the initiative and examine and palpate the legs of a bed patient long before swelling becomes manifest. Nurses and patients should be instructed to report any pain in the extremities. The deep veins of the leg are best palpated when the patient lies on his back with his knees elevated. The examiner stays at the foot of the bed and simultaneously palpates the muscles of the calves of both legs. An increase in consistency can readily be determined by this method. As the thrombotic process advances the findings become more positive. Thrombosis in the plantar veins is determined by tenderness in the sole of the foot. The adductor regions in the thigh are examined in the same manner as are the calves of the legs. Rectal and vaginal examination should be done to detect thrombosis of the pelvic veins. The early diagnosis of thrombosis must always be followed immediately by specific therapy.

Heparin should be given at once to obtain an immediate anticoagulant effect. It should also be used in a sudden attack of pulmonary embolism. The effectiveness of heparin is due to its antithrombotic effect. The coagulation time of the blood is prolonged by the intravenous injection of from 125 to 150 mgm. of heparin 4 times daily. Active movements are begun with the first injection. Deep breathing exercises and free movements in bed are enforced. When the temperature becomes normal the patient is allowed to sit up in a chair and heparin is reduced to 3 doses—100, 50, and 100 mgm.—per day. When the patient is allowed to walk an elastic

bandage is applied from the foot to the knee and the heparin is further reduced to 2 doses a day, 100 and 125 mgm., respectively. Increasing activity is encouraged and a single dose of 100 mgm. of heparin is given once daily. After discharge from the hospital, the patient is instructed to wear an elastic bandage as long as discomfort or swelling exists. The patient is also warned not to overstrain the leg. If the primary illness confines the patient to bed, heparinization must be continued for a longer period, while the patient is in bed.

Dicumarol exerts an anticoagulant effect by inhibiting the formation of prothrombin. The effect is obtained only after from 12 to 48 hours of administration and the degree of inhibition varies in different individuals. The prothrombin time is the index of the amount of dosage. On the first and second days an average of 0.25 gm. of dicumarol is required. When heparin and dicumarol are combined in therapy, the heparin should not be discontinued until the dicumarol effect is obtained as determined by the prothrombin time.

BENJAMIN G. P. SHAFIROFF, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Smyth, H. F.: Anthrax: Its Diagnosis and Treatment. *Occup. M.*, 1946, 2: 8.

There were 408 reported cases of anthrax in this country from 1939 to 1943. Of these, 316 occurred in tanneries or woolen mills in 6 northeastern states. The disease was diagnosed early, and the patients were properly managed by trained personnel with a resulting relatively low mortality. The remaining patients were usually seen by different physicians with little or no previous experience in the recognition and treatment of anthrax. The latter group suffered a higher mortality incidence.

This article was prepared for the benefit of those who, on occasion, may encounter a case of anthrax. The salient features of the incidence, clinical diagnosis, and bacteriology were discussed, and emphasis was placed on the necessity of instituting treatment promptly, even before the diagnosis can be substantiated. The oftentimes fatal bacteriemias and malignant forms of anthrax can thus be aborted.

Local treatment has been condemned, generally, as being unnecessary and even undesirable. Since the advent of the use of serum, at the turn of the century, the mortality rate has been reduced, but because of alarming reactions, other agents have superseded the use of serum. One of these has been neoarsphenamine either alone or combined with serum. The author recommends the former course, since, in 62 instances, not a single fatality occurred when the arsenicals were used alone. A mortality rate of 4.7 per cent resulted in 64 collected cases when sulfonamide drugs were the sole agent. Although penicillin may prove extremely effective, too few cases have as yet been reported to allow any conclusions. DAVID H. LYNN, M.D.

Ellingson, H. V., Kadull, P. J., Bookwalter, H. L., and Howe, C.: Cutaneous Anthrax. *J. Am. M. Ass.*, 1946, 131: 1105.

The early treatment of anthrax was given by means of cautery or excision, and was attended with a fatality rate ranging from 30 to 60 per cent. After the introduction of Sclavo's antianthrax serum, radical local treatment was gradually abandoned with improvement in the recovery rates. Lucchesi and Gildersleeve reported 67 cases treated with serum, neoarsphenamine, or both, without a single death. Gold reported 60 cases of cutaneous anthrax treated with serum, neoarsphenamine, and various sulfonamides, with only 1 death.

The treatment of anthrax with penicillin was suggested in 1941, when Abraham and his associates reported the in vitro sensitivity of the Bacillus anthracis to this antibiotic.

The authors give a report of their observations on 25 consecutive cases of cutaneous anthrax. The Bacillus anthracis was recovered from the blood of 3 of the patients. All were treated with penicillin, and 3 were treated with sulfadiazine in addition to the penicillin. All recovered uneventfully. They were under close medical surveillance at all times, and general treatment was initiated while the lesions were in relatively early stages.

The lesions were located for the most part on exposed areas of the body. HARRY W. FINK, M.D.

Gay, E. C.: Skin Dressings in the Treatment of Débrided Wounds. *Am. J. Surg.*, 1946, 72: 212.

A series of 101 cases of the application of split thickness skin grafts is presented and the relationship of this work to general surgery and to orthopedic surgery is discussed. Six of the cases are reported in brief with photographs. Successful takes of the grafts were obtained in 87 per cent of the cases.

The entire effort is based on an attempt to convert large tissue defects, received in war injuries, into rapidly healing closed wounds, which shortens the patient's period of hospitalization and convalescence, and returns him early to limited or full military duty, or allows for more comfortable evacuation to the Zone of the Interior.

In conclusion, the author states that the optimum time for the use of split skin grafts as a "skin dressing" to large tissue defects, received as war injuries, is between the fifth to the tenth day after injury.

These grafts are practical in the presence of excessively exuding wounds, and also in the presence of mild surface infection. They may be used in combination procedures involving drainage of dependent areas, partial secondary closures, and skin grafting.

The application of dressings at forty-eight-hour intervals offers the greatest opportunity to combat excessive exudation, which is a predominant feature of massive war wounds; this technique gives the greatest protection to the grafts applied.

Grafts used for this purpose should be very thin, since the thin split thickness graft shows a higher percentage of complete takes in the presence of

excessive exudation or moderate infection than the deep intermediate grafts.

The donor areas of thin grafts are less likely to become secondarily infected and heal without delay.

Failure of these grafts to take is attributed to retained foreign bodies and/or excessive infection as a result of deep penetrating wounds, not thoroughly opened in the primary débridement of the wound, or missed during inspection of the wound.

These grafts are not to take the place of secondary closures, but serve as an adjunct to general and orthopedic surgery in the care of war injuries which involve massive loss of skin surface.

The time necessary for the consummation of this work lies within a 30 day period.

The potentialities of the use of split thickness skin grafts applied early in the treatment of war wounds should be easily transcribed to traumatic surgery of civilian practice.

Robinson, D. W., Stephenson, K. L., and Padgett, E. C.: Loss of Coverage of the Penis, Scrotum and Urethra. *Plast. Reconstr. Surg.*, 1946, 1: 58.

The authors state that for the reconstruction of loss of the penile skin covering alone, 2 methods are applicable. In an instance in which the injury is incomplete, a flap from the scrotum can be used. A flap from the thigh or abdomen is too thick. Another procedure is to cover the defect with a nonhair-bearing split graft. Oftentimes these split grafts are put on in tunnel fashion, running lengthwise so as to afford sufficient skin for easy erection.

When both the penis and scrotum are denuded of skin, grafting should be done as soon as possible. At the same time the testes should be implanted on their respective sides beneath the skin of the thigh fairly well back and down as far as possible. Subsequently these flaps are taken loose from the thigh, resutured to each other so as to create a new scrotum, the donor sites being covered with split grafts. In cases in which a portion of the urethra is missing, it is necessary, first, to divert the urine, since an intra-urethral catheter for carrying the urine probably does more harm than good. The urethra is re-established, as in a hypospadias operation. When there is loss of the cavernosa, a flap is superior to a skin graft. The insertion of cartilage is a procedure in which the authors have had no experience. They state, however, that it may possibly prevent some lateral curvature on erection.

Twelve cases of various injuries of this type are cited, and the general method of treatment is given.

LOUIS T. BYARS, M.D.

McDonald, J. J., and Webster, J. P.: Early Covering of Extensive Traumatic Deformities of the Hand and Foot. *Plast. Reconstr. Surg.*, 1946, 1: 49.

To convert an open wound into a closed wound as soon as possible is a fundamental surgical procedure. When it is impractical to close a wound immediately, primary healing can often be obtained by secondary closure within a period of 4 to 10 days. The penalties of neglect are permanent and costly. They include healing with the formation of granulation tissue, contracture, sloughing of tendons, osteomyelitis, and suppurative arthritis. Treatment then is markedly complicated and prolonged. The disability may become permanent. Where viable skin flaps remain, simple closure is the best procedure. For covering larger areas, a simple skin graft may be used and may afford a permanent covering. In instances in which joints are opened and nerves, tendons, or bone fragments exposed, the shifting of an adjacent flap should be used.

When concomitant injuries occur and definitive treatment must be postponed, closure of the wound should be delayed, local treatment being limited to débridement and the application of a pressure dressing with immobilization. Chemotherapy should be used and if, after 4 or 5 days, there are no signs of infection, and the patient is out of danger, tissues which are still of questionable viability may be excised and the wound then covered with a split skin graft or a pedicle flap.

In certain instances early covering with a split graft and later replacement with a pedicle flap offers certain advantages. The authors cite a case of a boy who had a fracture dislocation of the ankle and the mid-tarsal joints with an associated avulsion of the skin and soft tissues from the dorsal and lateral aspects of the foot. The open surface was covered with a split graft. The fracture was immobilized and after sufficient healing had occurred, the patient was discharged. At a subsequent date he was re-admitted to the hospital and a pedicle flap was used to provide a more durable covering for the dorsum of the foot. He subsequently had tendon transplants beneath this flap.

LOUIS T. BYARS, M.D.

McDonald, J. J., Cadman, E. F., and Scudder, J.: The Importance of Whole Blood Transfusions in the Management of Severe Burns. *Ann. Surg.*, 1946, 124: 332.

The authors present a series of 10 selected cases of severe burns involving from 30 to 80 per cent of the body surface, in which an analysis of shock therapy is emphasized.

The rationale for giving whole blood transfusions and electrolyte solutions is discussed and advocated on clinical and experimental grounds. The indication for whole blood is to replace blood loss. In shock from severe burns the changes in hemodynamics are equivalent to those of a massive hemorrhage combined with an additional loss of water and electrolytes (dehydration) and are not simply those of a plasma "leak." When shock was controlled by blood transfusions, fluids were usually well tolerated by mouth and vomiting ceased.

Since employing sodium lactate therapy by mouth or vein during burn shock, the authors have noted three striking beneficial effects: (1) acidosis is more quickly controlled, as reflected by the plasma carbon dioxide capacity; (2) excess potassium is quickly eliminated from the circulation; and (3) the urinary

output is improved. When lactate solution is the only electrolyte given, there may be a tendency to overcorrection of the acidosis, even to the point of clinical alkalosis, as noted in some of the cases. Electrolyte therapy should consist of a mixture of lactate and saline solution, or bicarbonate and saline solution. Oral administration should be started as soon as vomiting has ceased.

Replacement therapy in burn shock should be directed toward the restoration of all deficits in the circulating blood. These include red cells, plasma, proteins, water, and electrolytes. Whole blood transfusions fulfill these requirements more closely than any other single agent. The presence of anemia is a recognized indication for blood transfusions during the healing stage of burns, but when hypoproteinemia is more severe than the red cell deficit, it is generally believed that plasma, albumin, amigens, or amino-acid infusions are indicated. The authors suggest that whole blood, rather than blood substitutes, is more effective in maintaining nitrogen balance, and that a moderate excess in red cell mass may be indicated during the healing stage of severe burns. Several reasons for this stand are given:

1. When the viscosity of the blood is reduced by the depletion of plasma proteins, a moderate excess in red cell mass will increase the viscosity of the blood and thereby contribute to more normal hemodynamics.

2. As a source of protein, whole blood contains almost twice the concentration of an equal volume of plasma, since the hemoglobin content represents roughly 2½ times as much protein as the plasma content of whole blood. When a unity of blood is given, its plasma component is immediately available to augment the plasma proteins or body reserves; its red cell mass, if in excess of normal, represents a rich store of protein, readily available.

3. Experimental work on dogs by the authors suggests that an excess red cell mass may have an immediate sparing action on body proteins by displacing plasma volume and thereby reducing the amount of plasma in wound healing. Whole blood alone failed to precipitate pulmonary edema in the experiments, but this condition was encountered when saline solution was given with the transfusions.

4. Patients in this series in whom anemia was quickly corrected, or overcorrected, assimilated more protein given by mouth than those in whom the anemia was not controlled.

5. The patient in the process of forming a large granulating surface may have a physiological increase in his total blood volume to aid in the process of healing.

Provided whole blood transfusions are given, water and electrolytes can be administered more effectively by mouth than by vein, and will be absorbed in adequate amounts. Sodium chloride solution in combination with lactate or bicarbonate is a more rational electrolytic mixture than sodium lactate solution alone, in view of the tendency to alkalosis and hypochloremia, which may result from vomiting and overalkalinization in burn shock. In general, plasma losses will predominate in extensive second-degree burns, while in third-degree burns, the red cell mass lost from the circulation may equal or exceed the losses in plasma volume. If the anemia of the postshock phase of a severe burn is not prevented by giving adequate amounts of whole blood in the shock period, it should be corrected once recognized, for delay of even a few days may be disastrous. During the healing phase of a severe burn, whole blood should be administered in amounts adequate to theoretically overcorrect the anemia. When this is done, the problem of nitrogen balance will be simplified. In the presence of an anemia and hypoproteinemia, uncontrolled electrolyte therapy by mouth or by vein is contraindicated since it will increase cellular edema and in some cases may lead to fatal pulmonary edema.

JOHN H. MOHARDT, M.D.

Howes, E. L.: Prevention of Wound Infection by the Injection of Nontoxic Antibacterial Substances. *Ann. Surg.*, 1946, 124: 268.

A mixture of streptomycin (200 units per cubic centimeter) and sulfamylon (5 per cent) was found previously to be bactericidal as well as innocuous to tissues. To ascertain whether this combination was an ideal subcutaneous antiseptic and if it was capable of preventing infection in wounds, several experiments were performed on rabbits. The results are evaluated in this paper.

If crushed wounds were contaminated and not treated, infection always followed. On the contrary, if the wounds were treated immediately infection seldom occurred, but if treatment was instituted 3 hours or later after the wound was made and contaminated, infection resulted. Additional injections or washings, once infection occurred, did not resolve the process although the bacteria remained susceptible to the antibacterial agent. Debridement and treatment did prevent infection.

In an attempt to find an explanation, biopsies were taken of the loose connective tissues directly under the skin, and of the muscle. Microscopic examination showed that many leucocytes had already invaded the tissues and every leucocyte contained many bacteria. The most logical explanation of the failure to prevent infection after 3 hours is that many of the bacteria were no longer extracellular and were thus not reached by the antibacterial agent. While phagocytosis is helpful in combating infection, yet, if the leucocyte is killed before the bacteria are destroyed, the micro-organisms are free to contaminate the wound again.

Resolution of an established infection requires, in addition to a potent bacteriocide, adjunct chemotherapy—to dissolve slough, to explode leucocytes, and to provide chemical drainage. A word of caution must be said about the clinical use of these antibacterials to prevent infection in wounds. They, and the method of their employment, must not be substituted for good surgery; necrotic tissue and infected foreign bodies should always be removed.

Other antibacterials can be substituted for sulfamylon and streptomycin. Injection of antiseptic substances locally points to new possibilities in the local treatment of wounds. DAVID H. LYNN, M.D.

Egoroff, B.: New Lingual-Oral Method of Administration of Penicillin. *Vrachebnoe Delo*, 1946, p. 255.

Hydrochloric acid and intestinal bacteria inactivate penicillin administered through the digestive tract. The author avoids this drawback by applying penicillin to the tongue. Saliva, and especially ptyalin, do not destroy penicillin. One thousand Oxford units of dry penicillin are dissolved in 1 c.c. of water, normal saline, or 40 per cent glucose. One drop of the solution contains 5,000 units of penicillin. One to 2 drops are applied to the tongue every 30 to 60 minutes and the patient is instructed not to swallow but to distribute the solution with the tongue over the palate, lips, and gums. Patients prefer such a procedure to frequent injections. If larger doses are required, 10 drops may be administered at once.

If desired, 100,000 units of penicillin may be dissolved in 3 c.c. of alcohol, which irritates the mucous membranes and creates hyperemia, which, in turn, stimulates absorption.

If the tongue is coated, it should be cleansed with a toothbrush before the administration of penicillin.

Stomatitis, gingivitis, and pharyngitis do not form a contraindication to a local application of penicillin. Some patients prefer a sublingual administration of penicillin, but the presence of a relatively large amount of saliva in that region retards the absorption of penicillin.

While absorption of penicillin from lozenges is very slow, the drug reaches the circulation very promptly after its application to the tongue in liquid form. Penicillin is absorbed by the tongue, the lips, the gums, the mucous membranes of the oral cavity, the palate, tonsils, pharynx, and possibly also the esophagus. The three routes of absorption are through the veins, the lymph vessels, and the perineural and endoneural paths.

JOSEPH K. NARAT, M.D.

Rowe, A. H.: Delayed Healing of an Abdominal Wound Due to Food Allergy. *West. J. Surg.*, 1946, 54: 313.

The author reports the case of a 13 year old boy who had cramping abdominal pain associated with other gastrointestinal symptoms for a period of 5 years. Appendectomy, followed by failure of wound healing and a recurrent serosanguineous discharge, had been performed 2-½ years before his referral to the author. After 2 years another surgeon reopened, curetted, and resutured the wound with equally unsuccessful results. There was a family history of allergy. Physical examination was negative except for moderate diffuse abdominal tenderness and a membranous bulging fluctuant wound in the right lower quadrant. The usual scratch tests were negative, and there were no abnormal reactions following cutaneous and subcutaneous implantations of various suture materials. Gastrointestinal x-ray studies, wound cultures, and histological studies were not made.

The patient was placed on an elimination diet. Within 2 weeks the gastrointestinal symptoms disappeared, the wound healed, and has remained healed for 1-½ years. Subsequent studies indicated an allergy to milk which disappeared when the patient changed from a maritime to an inland environment.

The author concludes that the control of food allergy was responsible for the healing of a wound of 2½ years duration, and also for the control of lifelong gastrointestinal symptoms. There was no local wound treatment, no removal of any foreign substance, nor of retained sutures; no drugs or vitamins were given and there was no increased protein or caloric intake.

The assumption is made that accumulation of antibodies and allergens of the allergic foods, and/or a decrease in collagen and fibroblasts resulting from the localized allergy, was responsible for the delayed healing and recurrent discharge from the wound.

It is suggested that allergy be considered as one cause for delayed healing or necrosis in wounds in any part of the body, as well as abnormal sensitiveness in abdominal wounds, particularly in patients with personal or family histories of allergy.

S. LLOYD TEITELMAN, M.D.

Leigh, O. C.: A Report on Trench Foot and Cold Injuries in the European Theater of Operations. *Ann. Surg.*, 1946, 124: 301.

This article reports a detailed study of 500 of the 5,000 cases of trench foot observed at the 108th General (U.S.) Hospital, (E.T.O.) during 1944 and 1945.

Trench foot is a term used by the United States Army Medical Corps to describe the cold injury resulting from prolonged exposure to just above freezing temperatures (34° to 40°F). It has occurred almost exclusively in combat infantry riflemen who were forced into immobility by enemy action.

Frost bite is used to describe the cold injury resulting from exposure to below freezing temperatures—either of the ground type, occurring in the ground forces, or high altitude type, occurring in combat air crews. Immersion foot designates the cold injury resulting from prolonged exposure of the feet to cold water. These injuries are usually described as different clinical entities, although the evidence indicates that they all present similar pathological changes and can be treated identically.

The incidence varied from 3 to 50 per cent of battle casualties, depending upon near freezing or freezing temperatures, wetness, immobilization of ground forces, inadequate and ill fitting foot gear, and failure or inability to enforce strict foot discipline. Company commanders most successful in avoiding casualties required each soldier to exchange

wet socks for clean dry ones, and relieved a few soldiers from each group daily for a short time, during combat activity.

Etiologically, three factors were always present: (1) wet cold; (2) prolonged exposure in a relatively immobile position; and (3) physical activity following the exposure. Of these factors, wet cold is the most important.

In trench foot, the sequence of events leading to injury are fairly constant. The combat infantry soldier is forced into immobility in a wet foxhole for a prolonged period of time. He first complains of a tingling or stinging sensation in his feet, which may become quite intense. After a period of exposure, the feet become numb, and finally anesthetic. When the attack is ordered, or he is relieved, walking causes severe burning pain, and on removal of his shoes, the feet become swollen and warm. Many soldiers complained that their shoes were too small after several days of exposure.

The immediate reaction of the skin to cold is a blanching in color. The blanching is caused by contraction of terminal arterioles and veins. The sensation of cold appears as the skin temperatures are reduced to 25° and then to 15°C. At these temperatures, the skin develops a bluish color (cyanosis) which indicates local oxygen deficiency. As the temperatures are lowered to 10° and to 8°C, the bluish color changes to purple, and finally to a bright red or pink. These color changes indicating excess oxygen locally are the result of decreasing tissue metabolism and a lower oxygen dissociation from the blood at these temperatures. Each of the color changes may be transient or prolonged, according to the degree of cold, duration of exposure, and speed of wind currents. If the surrounding temperature is returned to normal after a short exposure, no further reaction will occur. If prolonged, secondary pathological reactions follow.

In first-degree injuries (36.4% based on 500 cases) the color changes and sensations encountered during exposure are quite similar to those described above. When placed in a warm environment, the foot develops a bright red flush. The larger vessels show increased pulsations for a few hours, and the skin appears thicker from edema. Tingling of the feet is felt early and later, itching, burning, or mild throbbing pain. This hyperemic or inflammatory stage subsided within 3 days, (1–6 days), after which the foot assumed a normal appearance. All patients were walking without pain within 4.2 days (from 0 to 10 days) after exposure. This group of patients was returned fo full duty after a short period of rehabilitation.

In the second-degree injuries (55.6%) the reaction after exposure is more severe, with hyperemia, pulsation of the larger vessels, and throbbing pain, which may last for several days. Blisters appear and intracutaneous ecchymosis develops on the weight-bearing surface of the foot and toes. The edema subsided on the average in 8.4 days (from 6 to 10 days), and was followed by varying degrees of scaling; the skin was sensitive and perspired profusely. The feet became warm and painful on exercise and in a warm environment. Exposure to cold is more comfortable for the patient. Most of these patients were returned to limited duty, but many were later discharged as unfit for any kind of duty.

In the third-degree injuries (8%) the initial reaction is intense in 3 or 4 hours after the foot is placed in a warm environment. All the cardinal signs of inflammation are present—marked edema, heat, redness, and burning throbbing pain. Large blisters, intracutaneous ecchymosis, and superficial skin necrosis are present. The inflammatory stage averaged 12.4 days (from 7 to 32 days), only rare cases showing persistent edema for more than 14 days. The superficial layers gradually mummified and desquamated, leaving a pink sensitive skin. On dependency, the skin assumed a dusky, cyanotic hue. None of the patients could walk without severe pain and disability during the 3 month period of observation, and were unfit for further duty. One severe case required amputation of the feet. Digits were lost in 1 per cent of 500 cases.

Once hyperemia has developed, treatment is directed toward preserving the superficial injured layers of epidermis, which forms a tough dry protective covering of the viable layers beneath. The foot is exposed to a cool, dry environment and kept elevated on pillows. In the earliest stages of hyperemia, pressure bandages over cotton decrease edema and relieve pain. Surgical amputation should never be done in the early stages, except for gross secondary infection. Dry gangrene of the toes occurred in only 1 per cent of the carefully followed cases. If infection is present, sulfa drugs and penicillin should be used as in any other infection. Tetanus toxoid is given in open wounds. After the edema has subsided the treatment is directed toward the prevention of foot deformities caused by atrophy of the muscles and fibrosis. Supervised exercise of the feet, physiotherapeutic measures, and guarded ambulation should be initiated at the earliest possible moment. The use of vasodilator drugs and lumbar sympathetic block was investigated; these measures did not give relief from pain and did not decrease the convalescent period. The pathological and physiological changes in trench foot are similar to frost bite, but less severe. The basal germinal layer of epithelium remains intact in trench foot, but is lost in frost bite.

JOHN H. MOHARDT, M.D.

King, P. F.: Erysipeloid: Survey of 115 Cases. *Lancet*, Lond., 1946, 2: 196.

The material studied consisted of 115 unselected cases of erysipeloid among 2,300 cases of all types seen in the septic hand clinic at Charing Cross Hospital from May, 1941 to the end of December, 1945. The condition was first described in 1873 by Baker and renamed erysipeloid in 1884 by Rosenbach.

The causal organism is the gram-positive bacillus, Erysipelothrix rhusiopathiae, which causes erysipelas in pigs. The cutaneous form is the commonest al-

though intestinal and generalized forms have occurred. The infection results from contact with organic matter, usually mammals, fish, shellfish, bones, flesh, or shells, but vegetable material or any form of nitrogenous products may also bring on the condition. The lesion occurred in 5 per cent of the septic hands at this clinic and was almost restricted to people employed at catering; thus it was an occupational disease.

The lesion manifests itself from 2 to 7 days after the initial injury, which may be a cut, scratch, or puncture of the skin. It is characterized by a dark purple-red zone, sharply defined and raised, in the center of which the site of injury is often found to be healed. It usually occurs on the fingers, and from about the third to the fifth day the lesion extends peripherally, the change being most noticeable toward the upper part of its distribution. After about a week the central part of the rash fades and desquamates, while the periphery continues to extend. It is common for the spread to reach (1) the palm or dorsum of the hand, (2) the neighboring webs, (3) the adjacent sides of the neighboring fingers, and (4) the proximal phalanges of the neighboring fingers. The lesion appears to be commoner on the middle fingers and the thumb, particularly of the right hand.

The rash is accompanied by a sensation of heat, burning, and irritation of the part, which may become considerably swollen, and gives rise to a feeling of local tightness. Stiffness of the interphalangeal joints is common, with resulting limitation of movement. Pain is common, especially early, and becomes worse where the lesion extends, while at the same time it eases centrally. It may be throbbing, burning, or smarting. There is a subcuticular extravasation of blood sometimes.

General symptoms are inconstant. Regional lymphangitis and lymphadenitis may occur. Of the 115 cases, only 5 showed lymphangiitis and only 2 localized adenitis. There may be arthritis of the interphalangeal joint and this may lead to stiffness.

Erysipeloid is characterized by regressions and relapses. The average duration of the disease treated in this series was under 17.4 days, but any time from 14 to 28 days is common. The variation was between 51 and 7 days. In the latter stages the lesion fades from the periphery inward. The lesion must be differentiated from erysipelas.

Erysipeloid has a seasonable incidence concurrent with epidemics of swine erysipelas and thus the greatest seasonal incidence is during the summer and early autumn. The author believes it is possible that the fly may be a vector carrying the organism from the feces of infected pigs and contaminated organic material.

Of 115 cases, 95 occurred among persons employed at catering and including housewives. The highest incidence occurred among cooks (50.8%, if one considers each housewife in this class). Barmen, waiters, kitchen hands, and others account for 22.6 per cent, and fishmongers, poulterers, and butchers for a further 9.5 per cent. In this series, of the 20 persons not employed in the catering trade, 6 were infected from an animal source, 6 from a plant source, and 8 from an unknown source.

There seemed to be no special age and sex distribution.

Immunity is not conferred by one attack. Of the present patients 2 had second attacks.

The treatment is entirely medical with rest of the part as the fundamental principle; this is best obtained by not allowing the patient to work, using a high sling to keep his hand and forearm relatively immobile, and applying hot wet boric dressings. The author believes that penicillin given systemically may be of considerable value although he did not use it.

LEROY J. KLEINSASSER, M.D.

ANESTHESIA

Poe, M. F., and Karp, M.: Seconal as a Basal Anesthetic Agent in Children: A preliminary Report. *Current Res. Anesth.*, 1946, 25: 152.

Basal narcosis is especially useful in the management of children undergoing surgical procedures. It spares the child the psychic disturbance attendant upon the trip to the operating room and induction of anesthesia. It reduces the amount of inhalation anesthesia as much as possible and it provides a period of postoperative rest and amnesia.

Seconal, a short-acting barbiturate, was chosen for trial as a basal depressant because of its quick action and its relatively short duration. The basis for estimating dosage was the age and weight of the patient, but consideration was given to the child's general condition, body build and vigor, and nervous reactivity. A calculated dose of from 0.14 to 0.15 grain (9–9.5 mgm.) per pound gave the optimum degree of narcosis. It was planned in all cases to use local infiltration, and the basal anesthesia was employed to provide a manageable patient. Whenever pentothal sodium or other supplement was anticipated, atropine sulfate was administered subcutaneously as part of the postoperative medication. Seconal is rapidly absorbed when given either by mouth or by rectum. Oral administration was employed when feasible.

Seconal was used in 22 neurosurgical and in 3 ophthalmological procedures in children ranging from 3 months to 6 years of age. The majority of children in this group were in good physical condition, the procedures being performed for diagnosis. Side effects observed were a rise in pulse rate, some decrease in respiration, and a fall in blood pressure.

MARY FRANCES POE, M.D.

McAllister, F. F.: The Effect of Pentothal Sodium on Mean Arterial Blood Pressure in the Presence of High Spinal Cord Paralysis. *Ann. Surg.*, 1946, 124: 328.

The effect of pentothal sodium on mean arterial pressure in the presence of high spinal cord paralysis produced experimentally in dogs, is reported. The

increasing use of intravenous barbiturates in conjunction with spinal anesthesia, and the fact that ether is known to act unfavorably on blood pressure when the spinal cord impulses are interrupted at the level of the sixth thoracic segment or above it, prompted this study.

Spinal cord transections were made aseptically in the lower cervical region between the sixth cervical and the first thoracic segments. Control determinations of blood pressure were done on normal dogs.

The author's experiments on dogs indicate that when the function of the spinal cord has been interrupted in the lower cervical or upper thoracic region, intravenous pentothal sodium produces no serious depression of the blood pressure. Thus, this anesthetic is quite different from ether, which is known to cause a pronounced fall in the blood pressure of such animals. Experimentally, then, when the suprasegmental vasomotor control has been eliminated, intravenous pentothal is a safer anesthetic than ether. JOHN H. MOHARDT, M.D.

Booker, W. M.: Observations on the Carbohydrate Metabolism during Prolonged Pentothal Anesthesia in Dogs: The Blood Sugar and the Liver Glycogen. *Anesthesiology*, 1946, 7: 405.

In view of a dearth of experimental work, clinical as well, on the far-reaching effects of prolonged pentothal anesthesia, it seemed important that studies in this connection be launched to determine the feasibility of prolonged pentothal anesthesia, keeping in mind those effects which may tend to vitiate the recovery powers of the animal or the patient.

The work reported here was done on approximately 45 dogs. Glycogen determinations were made on livers of all animals routinely, 36 to 48 hours after the period of anesthesia. In a few of the early experiments liver function tests were also performed. Animals were anesthetized with a 3 per cent solution of pentothal sodium injected into the antecubital vein. Blood sugar on 0.2 c.c. of blood was determined by the Gibson micro method which is a modification of the Folin-Wu method. The Benedict method for glycogen determination was employed. The results bring to our attention the interesting point that when pentothal is administered at frequent and regular intervals, a point at about 3 hours is reached when the administration falls off both in frequency and amount. One of two things is occurring: either the machinery for handling the pentothal has become embarrassed and more and more pentothal is building up in the tissues, or the nervous system has become more adapted to its state of depression, so that less and less amounts of anesthetic are necessary for maintenance of that depression. Full cognizance is taken of the fact that the fate of pentothal is controversial.

In the experiments reported in this paper, there were a few instances in which the ureters were tied off immediately after the first injection without any difference noted in the frequency or amount of anesthetic administered throughout the period of anesthesia (4 to 6 hours). In one experiment the kidneys were removed entirely, but the frequency and dosage did not vary from the usual pattern. This is good indirect evidence that in the dog pentothal is not excreted appreciably by the kidneys. Liver function tests tend to show that as anesthesia progressed, the ability of the liver to remove bromsulfalein from the blood is lowered. This would seem to indicate that the liver is undergoing some type of strain or taxation during the progress of the anesthesia, so that its removal of bromsulfalein from the blood lags. The rise of blood sugar is in agreement with the observation of Marshall, who called attention to a mild hyperglycemia followed by a hypoglycemia in recovery phases under pentothal anesthesia. Whether or not this represents a damage or a strain on the liver may be open to controversy. It may be agreed, however, that something occurs in the liver to cause glycogenolysis with a resultant increase in blood sugar. Could it be that the enzyme system responsible for converting and maintaining glucose to glycogen is interfered with so that control of the liver glycogen is temporarily lost?

The influence of prolonged pentothal anesthesia on the glycogenolytic-glycogenic activity seems to be shown further in the inanition experiments. When animals deprived of food were given sugar just prior to anesthesia and were anesthetized for 4 hours, it was found that the blood sugar was extremely high, remained high throughout the experiment, and was still high 24 hours later. It seems that the liver of the animals in the anesthetized series is unable to handle the excess glucose, even though its glycogen has been markedly lowered by deprivation of food. It may be that an explanation lies in the interruption of the glucose-glycogen pathway somewhere in the intermediary metabolism.

The high carbohydrate series of experiments was undertaken to determine whether or not good glycogen storage could withstand the depletory effect of pentothal. We see that although the livers of this series store glycogen in extremely high quantities (no pentothal experimentation), livers of animals on high carbohydrate diet (prolonged pentothal anesthesia) are markedly lowered in glycogen. It seems questionable, therefore, whether or not the liver can be "protected" in prolonged administration of pentothal by either building up the patient with a high carbohydrate diet or injecting glucose concomitant with the anesthesia. We are of the opinion that in prolonged anesthesia, glucose, when administered in a very high quantity, is not converted into glycogen and stored in very high quantity and preanesthetic glycogen stores are lowered by prolonged anesthesia.

MARY FRANCES POE, M.D.

Apgar, V.: Experience with Curare in Anesthesia. *Ann. Surg.*, 1946, 124: 161.

Two hundred anesthetics were supplemented by curare and the author's experiences are recounted.

In all cases the anesthetic was administered by physician anesthetists after at least 3 months of

active residency. The technique of curare administration is described in detail. The curare (intocostrin) used was found to mix freely with saline, glucose, or blood, but a precipitate with all pentothal concentrations was formed. The cases were tabulated as to type of surgery performed, type of anesthetic used, reason for the use of curare, amount of curare used, respiratory and circulatory effects of curare, and the return of reflexes.

One death was believed to be related to the use of curare, and due to accidental overdose and too vigorous resuscitation.

The results obtained in the 25 tonsillectomies in which pentothal and curare were administered were appreciably better than a parallel series of cases without curare. Recovery in the group who had not had curare was prolonged and marked by extreme restlessness, necessitating much more nursing care than the group who had received curare. Only 3 per cent received prostigmine in 0.5 mgm. doses and no effect was observed in these patients.

The main disadvantage to the use of curare has been the difficulty experienced in teaching the signs of anesthesia. The demand for the drug during upper abdominal operations has increased to such an extent that it may not be necessary to teach third and fourth plane anesthesia. It is believed that curare has already assumed a permanent place as a supplement to anesthesia. MARY KARP, M.D.

Holaday, D. A.: Nitrous Oxide-Cyclopropane-Curare Anesthesia; A Review of 200 Cases. *Anesthesiology*, 1946, 7: 426.

The recent advent of a purified, uniform extract of curare has provided the means by which an increasing number of anesthetists are obtaining relaxation during light general anesthesia. Curare, acting peripherally, paralyzes skeletal musculature progressively and quantitatively. Thus the differential paralysis of all somatic muscles, save those necessary for respiration, may be procured. The mode of action is interference with the chemical transmission of impulses to the motor end organ, where such mechanism is cholinergic, and affects neither the normal conductivity of the nerve nor the contractility of the muscle fiber. In increasing dosage curare appears to affect the autonomic nervous system and probably the central nervous system. Unna and coworkers have observed that in vagotomized animals a bradycardia results from administration of beta-erythroidine, a tertiary ammonium base closely related pharmacologically to curare. There is evidence that curare also affects the central nervous system. Pick and Unna think it is likely that this is the result of an interference with synaptic transmission within the central nervous system. Thus, it is apparent that curare has no simple peripheral action, but rather a multiplicity of effects on the nervous system. Curare was adopted by the author as an adjunct to anesthesia with the thought that it would more safely provide relaxation for long operations. A review of the first 200 cases in which it was used is presented. About one-seventh of these patients were poor risks and more than one-third were only fair risks.

The first cases were conducted by a method similar to that described by Cullen. It shortly became apparent that second plane anesthesia was not required for fully curarized patients. Anesthesia was then induced with cyclopropane and later lightened with a mixture of nitrous oxide and cyclopropane. The postoperative course of these patients was improved in that they reacted sooner and showed less depression of blood pressure and pulse rate.

This technique was later modified to eliminate the induction with cyclopropane. Doses of from 20 mgm. to 30 mgm. of morphine sulfate and 0.3 mgm. of hyoscine hydrobromide were given for premedication. Additional morphine sulfate was administered at approximately hourly intervals during the longer operations to maintain a basal narcosis. Anesthesia was induced with 85 to 90 per cent nitrous oxide and maintained in light first plane by a mixture of 60 to 70 per cent nitrous oxide and 1 to 2 per cent cyclopropane in oxygen, delivered into a semiclosed carbon dioxide absorbing system. Curarization was initiated with 40 to 60 units of curare at the time of incision of the skin.

The course of the patients in the operating room was satisfactory. Postoperatively, however, respiratory depression sufficient to require nasal oxygen and other supportive treatment was frequently encountered. Thereafter the initial dosage of morphine was reduced to from 10 to 20 mgm. with no additional dose being given except in a few cases in which the operation lasted more than two hours. Too light anesthesia with concurrent curarization, however, has its complications. Reflexes of sufficient strength to produce spasm of the muscles of respiration can be initiated by excessive stimulation in the operative field. Additional curare may correct this, but may also produce undesirable respiratory depression. A more satisfactory method for interrupting these reflexes is to deepen the plane of anesthesia. We found it expedient, therefore, to insure adequate premedication with morphine and to increase the concentration of cyclopropane in the anesthetic mixture to from 5 to 8 per cent during the initial phases of the operation. Cyclopropane can usually be reduced to 1 or 2 per cent concentration as soon as the exploration has been completed, and discontinued entirely after 60 to 90 minutes.

Curare and cyclopropane or nitrous oxide were used to supplement 5 inadequate spinal anesthesias. Curare was combined with sodium pentothal in 5 cases, without the appearance of severe respiratory depression or any noticeable augmentation of the curare effect, as has been reported. Ether was the principal anesthetic agent in 3 cases in which curare was used. The experience of the author with these cases supports the conclusions of other writers that ether potentiates strongly the action of curare. For 4 cases in which basal anesthesia was established with avertin, 20 per cent less curare was required to pro-

duce intercostal paralysis than for corresponding cases in which inhalation anesthesia was employed without avertin. Curare was administered intramuscularly in 7 cases. The full effect develops over a period of 15 to 20 minutes, but the duration of effect is about 40 minutes. It must be emphasized that the rate of absorption of drugs administered intramuscularly is a function of the state of the circulation. If the blood flow should be impaired in any way while a significant amount of curare remains in the tissues, subsequent improvement in the circulation may produce a dangerous degree of curarization at a time when the patient is not properly attended.

Various patients included in this study were selected because they were poor risks. These included some patients on whom a surgical procedure would not have been attempted except for the availability of an unusually favorable type of anesthetic. The average operating time was 119 minutes. The smallest intravenous total dose of curare was 20 units; the greatest total dose was 300 units. The average total dose was 152.7 units. The average initial dose was 74.65 units. Curare was usually given in divided doses over a period of 10 minutes, starting with 40 or 60 units. Maintenance doses were 20 units given every 20 to 30 minutes.

Pulmonary complications were encountered postoperatively in 8 cases. Severe respiratory depression requiring intermittent compression of the rebreathing bag to assist ventilation occurred nine times in the series. In every case in which it was required, artificial ventilation by this method was adequate to carry the patient over the period of depression. In certain cases, however, especially those involving elderly arteriosclerotic individuals having a tendency toward hypertension, the blood pressure rose as much as 100 points during a period of apnea and returned to normal only after full, spontaneous respiration was resumed. This was interpreted as indicating, first, that the most skillfully applied artificial method for ventilation is not as efficient as the patient's own unimpeded respiratory movements, and second, that curare apparently does not interfere with the normal compensatory mechanisms of the cardiovascular system for combating hypoxia. Five cases are presented in detail.

The type of anesthesia developed during this study, by permitting the use of unusually light planes of anesthesia, may be employed to advantage for almost any type of operation. Its greatest benefits, however, lie in its use in long, shock-inducing abdominal operations in which relaxation is a prerequisite, and in providing safe anesthesia for poor risk patients. It possesses few of the disadvantages inherent in other methods. The degree of success with which balanced nitrous oxide-curare may be used depends upon the skill of the anesthetist. The dangers associated with its use result from overcurarization, or under-anesthetization.

MARY FRANCES POE, M.D.

Sarnoff, S. J., and Arrowood, J. G.: Differential Spinal Block. *Surgery*, 1936, 20: 150.

Six patients were given light procaine solutions into the lumbar spaces by means of the continuous intraspinal method of Lemmon. Eight thermocouples were then placed as follows: 1 on the plantar aspect of each great toe, 1 on the lateral aspect of the dorsum of each foot, 1 each on the palmar aspect of the right thumb and middle finger, and 2 in different parts of the room. The thermocouples were connected to a device which continuously recorded their temperatures. The initial dose of 10 c.c. of a 0.2 per cent solution of procaine hydrochloride was run in about 3 minutes. Thereafter 15 drops per minute were allowed to run in until the desired effect or height of block was attained.

Blood pressure, pulse, and neurological observations were made at regular intervals. Neurological examination included the appreciation of pin prick, proprioceptive vibration, heat and cold sensation, and motor activity. An increase of skin temperature from 24°C. to 31.5°C., or above, was assumed to have caused a complete block of the vasoconstrictor nerve fibers in that area.

It was concluded from these experiments that it was possible to introduce a concentration of procaine into the subarachnoid space which would block the fibers carrying vasoconstrictor impulses to the periphery and also those concerned with pin prick, without materially affecting fibers concerned with touch proprioception, vibratory sense, or motor power. This was termed differential spinal block. Hypotension was considered a result of the interruption of sympathetic vasoconstrictor fibers and not due to muscular flaccidity or diminished thoracic excursions. It was found also that the level of loss of sensation to skin prick only very approximately parallels the level of block of other kinds.

MARY KARP, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Lofstrom, J. E., and Nurnberger, C. E.: Irradiation Sickness; Histamine Effect Treated with Benadryl. A Preliminary Report. *Am. J. Roentg.*, 1946, 56: 211.

The authors recommend the use of benadryl (beta-dimethylaminoethyl benzhydryl ether hydrochloride) for irradiation sickness. Eighteen cases of irradiation sickness are summarized to demonstrate the relief of symptoms of anorexia, nausea, vomiting, weakness, and headache by the use of benadryl. All of the cases were improved by this medication. The degree of relief varied from patient to patient.

Both oral and intravenous administration of benadryl were tried with the impression that oral administration will yield the desired amount of relief in most cases of irradiation sickness. The fundamental causes and mechanism of this condition are not known. The basis of this study and theoretical explanation of the results rests upon the contention that histaminelike bodies are developed in the blood of patients subjected to roentgen therapy and upon the hypothesis that benadryl neutralizes these H-substances by virtue of its antihistamine action. Elevated blood histamine was found in the 1 patient in this series of whom the blood was examined.

The conclusion the authors draw from the small series of cases is that the use of benadryl in the treatment of irradiation sickness is beneficial.

FRANK L. HUSSEY, M.D.

Harper, R. A. K.: Some Observations on Roentgenography of the Pancreas. *Proc. R. Soc. M., Lond.*, 1946, 39: 534.

Roentgenography of the pancreas is of limited value at present and will remain so until excretory pancreatography is perfected. Since the diagnostic value of the symptomatology of pancreatic disease is disputable also, roentgenological examination is given preference for diagnosis, even in its present form.

Known methods of examination of the pancreas by x-rays are: Pneumoperitoneum (largely abandoned), gastric pneumography (largely abandoned), demonstration of opacities on abdominal films, barium studies of the stomach and the duodenum along its entire length for location of displacement, indentation, compression, invasion, and disturbance of the mucosal pattern, and barium studies of the small intestines for motility.

The conditions thus demonstrable are: postinflammatory calcification of the pancreas, calcified pancreatic duct stones, pancreatic cysts, enlargement of the gland due to chronic pancreatitis, anomalous head of the pancreas surrounding the duodenum like an annular tumor, primary carcinoma of the pancreas, metastatic carcinoma, and lymphosarcoma, Hodgkin's disease, and retroperitoneal sarcoma involving the gland or simulating pancreatic enlargement.

The differentiation between these conditions is rarely possible on a roentgenological basis. The differential diagnostic points are discussed.

GERHART S. SCHWARZ, M.D.

Somerville, E. W.: Air Arthrography as an Aid to Diagnosis of Lesions of the Menisci of the Knee Joint. *J. Bone Surg.*, 1946, 28: 451.

Many methods of visualization of the knee joint have been reported in the literature. In this series of 331 arthrograms, filtered air was used following 48 hours of skin preparation. The casette was curved, mounted on a 6 inch stand. Routine views consisted of 4 tangential views (round the clock views) of each meniscus. The medial or lateral joint was widened by holding the thigh firm and abducting or adducting the leg. McGaw and Weckesser (J. Bone Surg., 1945, 27: 432) devised a simple block frame for doing the same, without subjecting the examiner to excessive irradiation.

The medial meniscus is adherent to the capsule and tibial collateral ligament, appearing in the anteroposterior film as a small triangular density surrounded by air. The size of the meniscus increases in the tangential posterior views. The lateral meniscus is long and thin, extending from the capsule into the joint and it is raised from the tibia.

In the lateral posterior tangential view, the meniscus becomes more triangular in shape. It may be continuous with the capsule or slightly separated by the popliteal tendon. The latter separation is not to be misinterpreted as a tear.

The bucket-handle tear is found most frequently. The displaced fragment is seen usually in the intercondylar notch. Peripheral tears of the lateral meniscus result in undue anterior or posterior mobility of the meniscus with a defect which must be wider than 3/8 inches. (The usual popliteus tendon defect is 3/8 inch wide.) Remnants of the posterior horn, a contused meniscus, tag and discoid lesions, loose bone fragments, and semimembranosus bursa can be visualized.

A series of 331 knee arthrograms is reported. Of this group, 100 were reported as normal and 216 as positive for a meniscus lesion. In the second group, 205 patients were operated upon and a lesion was found in 195. In 4 of the 10 cases misdiagnosed, no lesions were found, in 3 there were synovial tags and hypertrophied fat pads, in 1 there was a loose body, in another, torn cruciate ligaments. The incidence of error was 4.5 per cent among 324 cases of knee pathology.

Although there are no contraindications to pneumography, it is not desirable in case of fluid in the joint. Arthrography is a useful adjunct to the clini-

cian in arriving at a correct diagnosis. Many excellent reproductions of meniscus lesions are illustrated in the text. MAURICE D. SACHS, M.D.

Frimann-Dahl, J.: On the Value of Planigraphy in Bronchial Cancer. *Acta. radiol.*, Stockh., 1946, 27: 99.

Fifty-six cases of bronchial cancer were examined by means of planigraphy. In all cases satisfactory films were obtained. In 46 the planigraphic findings were positive. (This material does not include a number of cases with known bronchogenic carcinoma which were not planigraphed for various reasons).

Survey films of these cases showed, likewise, a pulmonary density in 46 instances. Direct, or air, bronchography was successful in 10 cases, with positive findings in 6. Oil bronchography was performed in 12 cases. In the rest of the cases this procedure was deemed unnecessary and was omitted.

The author concludes that planigraphy is of great value in showing small cavities, bronchial narrowing, bronchial obstruction, endobronchial tumors, and peribronchial infiltration. It is the best method for differentiation between tumors which do not involve the bronchi and those which surround and involve the bronchial tubes, the latter almost always representing carcinomas.

The method is superior to bronchography with iodized oil because it does not require any preparation of the patient, it is harmless and fast, and it is more often conclusive than the other procedures. For accurate localization, planigrams in 2 different projections should be obtained. It is planned to arrange for planigraphy in the erect position routinely for the demonstration of fluid levels. Thus far this has been done only occasionally as the present equipment for this position was too cumbersome for convenient operation and a moving grid was lacking.

GERHART S. SCHWARZ, M.D.

Popp, W. C., and Watkins, C. H.: Roentgen Therapy for Leucemia. *Med. Clin. N. America*, 1946, 30: 799.

In general, in acute leucemia the disease is active and death may ensue in a few days to a few weeks. In chronic leucemia, the patient may live for from 2 to 4 years. In exceptional cases the process may be controlled for much longer periods. In the subacute forms the life expectancy will usually fall between these two extremes.

Roentgen treatment is as good a therapeutic measure in cases of leucemia as is known at the present time. Although the effect is entirely palliative, yet with properly supervised treatment a patient can be maintained in a useful capacity. Much disagreement is apparent between hematologists and radiologists as to whether or not roentgen therapy prolongs life. The authors inferred that in some instances life seems to be prolonged considerably. Even this may not be wholly true, the fact that the general health of the individual patient is usually maintained at a better level with the use of roentgen treatment is sufficient to warrant its acceptance as a therapeutic measure in the treatment of leucemia. The close co-operation of the hematologist and the radiologist is important in the successful care of leucemia.

MISCELLANEOUS

Thorndike, A.: Rehabilitation of the Surgical Patient in Army Hospitals in World War II. *Am. J. Surg.*, 1946, 72: 404.

During World War II the Medical Department of the Army developed an extensive reconditioning program, primarily in an effort to return as many wounded men as possible directly to active duty in as short a time as possible, but also to return to limited service or useful civilian life those individuals who could not be completely salvaged. The program was planned for the surgical patient and developed in 3 aspects—physical, educational, and occupational. The success of the Army surgery plus the reconditioning program was gauged by the return of 58.8 per cent of the wounded to active duty within the overseas theaters, the best results being from the Convalescent Centers of the European theater where 84.5 per cent of the patients were returned to duty within the theater.

This article concerns itself chiefly with the physical reconditioning program. The rehabilitation plan was started early in convalescence, with classes of exercises adaptable progressively to those in bed, in the ambulant ward, and in the fully ambulant group. There were also special programs devised for special categories of the wounded, such as the amputees, the thoracic cases, the paraplegic, the deaf, and the blind. It was found that even very early after injury the afebrile patient profited by exercises which used the uninjured parts, and later in convalescence, remedial exercises and occupations adapted to the specific injury were initiated.

The author makes no attempt to detail the whole program, but outlines the exercises designed for the bed patient since they are the most useful in civilian hospital practice. He accompanies the outline with a series of very clear figure diagrams for each exercise, and recounts the muscles used in each. It is understood that few, if any, bed patients are able to do all the exercises, the prescription in each case in Army practice being left to the discretion of the ward surgeon. LILIAN DONALDSON, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Forgacs, J., Kornegay, G. B., and Henley, T. F.: Studies on Streptomycin. Assay in Body Fluids. *J. Lab. Clin. M.*, 1946, 31: 514.

Various methods of assaying antibiotics are mostly modifications of the cylinder-plate method.

A method is described for assaying streptomycin in body fluids, particularly in the blood and in the urine. The method was developed in order to clarify absorption, excretion, and activity of the drug in human beings.

The amount of streptomycin is estimated from the width of the zone of inhibition observed on an agar plate seeded with a special strain of Bacillus subtilis.

ARTHUR J. LESSER, M.D.

Kornegay, G. B., Forgacs, J., and Henley, T. F.: Studies on Streptomycin. Blood Levels and Urinary Excretion in Man and Animals. *J. Lab. Clin. M.*, 1946, 31: 523.

Streptomycin was administered to mice, guinea pigs, rabbits, and human beings by intravenous, subcutaneous, intramuscular, and intraperitoneal injections, and maximum blood levels appeared from 15 to 60 minutes following injection.

An intramuscular dose of 30,000 units given to human beings every 3 hours resulted in blood levels from 1 to 2.5 units per cubic centimeter. Higher levels can be obtained by increasing the dose.

No changes in red or white count were found following the administration of streptomycin. Variations of the blood levels from a given dose were observed from animal to animal, and in the same experimental animal from day to day. Similar irregularities were observed in human beings. In man a considerable daily variation of urinary streptomycin excretion was observed, and a prolonged urinary excretion after cessation of streptomycin therapy was considered evidence of storage somewhere in the body.

No satisfactory vehicle for oral administration was found and the absorption of streptomycin from the gastrointestinal tract was not followed by therapeutic blood levels. ARTHUR J. LESSER, M.D.

Obarrio, J. M.: Acroparesthesia (Acroparestesia. La artritis de hombre, el plexo braquial y la acroparestesia de miembro superior). *Rev. As. méd. argent.*, 1946, 60: 557.

There are three clinical forms of acroparesthesia, namely: acroparesthesia diurna, acroparesthesia nocturnal, and mixed acroparesthesia. Associated disturbances are vasomotor, motor, and trophic, and also sensory disturbances.

In all of the cases seen by the author since 1915, the acroparesthesia coexisted with an arthritis of the shoulder, while the changes of simple acroparesthesia, which is a sensory disturbance, are due to a brachial plexitis. The scapulohumeral arthritis originates from a neuritis of the circumflex and suprascapular nerves. In the nocturnal and mixed form, the symptoms originate after arising because of an autointoxication originating during sleep. At night this autointoxication is neutralized but on arising there is an increased basal metabolism and a decreased carbon dioxide concentration in the blood, due to increased pulmonary ventilation, and thus the intoxication is aggravated.

ARTHUR F. CIPOLLA, M.D.

McLaren, J. W.: Calcium Gluconate Injection into Muscle. *Brit. J. Radiol.*, 1946, 19: 314.

It would appear that the injection of calcium gluconate carries with it some risk of damage to muscle tissue which may be of a serious nature. It is, however, difficult to ascertain the factor which causes the calcium deposition, since this happening must be of infrequent occurrence. Certain solutions of calcium gluconate may be unstable and therefore more likely to be precipitated, and it is suggested that a myositis may be set up, as the crystals of the gluconate are of the sharp needle type. It is also known that calcium salts are nonlipoid-soluble and are only absorbed with difficulty from adipose tissue, so that the injection should be made only into muscle and care taken that fatty tissue is not carried to the injection site by the needle. Experimental injection of calcium gluconate into rabbits has not produced any demonstrable calcification in muscle. The case recorded by Lamm shows that serious results can be brought about by injections of calcium gluconate, and though it would appear that absorption of the calcium usually occurs, there may be permanent damage which in some instances may be of an extensive nature.

The author reports another case of calcification in muscle, shown in roentgenogram.

JOHN J. MALONEY, M.D.

Abbott, W. E., Hirshfeld, J. W., Williams, H. H., Pilling, M. A., and Meyer, F. L.: Metabolic Alterations following Thermal Burns. The Effect of Altering the Nitrogen and Caloric Intake or of Administering Testosterone Propionate on the Nitrogen Balance. *Surgery*, 1946, 20: 284.

Previous studies indicate that both experimental animals and human beings show a characteristic metabolic response after thermal injuries. This reaction consists of a marked negative nitrogen balance, temporary elevation of the blood sugar and amino acid concentrations, salt retention, increased water intake and output with actual water retention, and temporary increase in urinary excretion of 17-ketosteroids and cortin.

In this article, the authors report the effect on the nitrogen balance of altering the food intake or of administering a nitrogen-retaining hormone (testosterone proprionate) in 45 burned patients and a group of animals with standardized experimental burns.

In moderate and severely burned patients the nitrogen deficit is more marked than in those with a smaller burn, and attempts at forced feeding of patients who show the greatest loss meet with the most difficulty. Consequently, a diet containing 1.6 times the basal caloric requirement (20 per cent protein) was started on the third day after the burn and was well tolerated by most patients. Such a diet kept nitrogen loss at a minimum and there was an earlier return to a positive nitrogen balance than in those patients receiving a lower caloric and protein intake. There was no evidence in a study of these patients that raising the carbohydrate content of the diet caused any significant sparing of nitrogen, nor was there any substantial effect noted from the addition to the diet of dl-methionine (in an amount equal to 1 per cent of the diet).

The severity of the nitrogen deficit bears a direct relation to the extent and severity of the surface area injured, and is also dependent upon sex, age, nutritional state, fever, infection, and type of therapy. High diets (from 3,000 to 5,000 calories containing from 100 to 300 gm. of protein) are probably deleterious during the catabolic stage following a burn, and should not be given during the first week or two.

Eight burned patients were given testosterone proprionate (25 mgm. daily for 10 days) without conclusive results as to the value of such therapy. This hormone reduces the loss of urinary nitrogen. It should not be used as a substitute for food, but used in an attempt to conserve and utilize better the maximum diet which the patient can tolerate. Androgenic therapy must be employed cautiously as it may produce masculine characteristics in women. It also causes water and salt retention; hence, it is preferable to delay instituting therapy until the catabolic phase has subsided (from 8 to 14 days). S. Lloyd Teitelman, M.D.

Cammermeyer, J.: Tumor of Tactile End Organs. *Arch. Path.*, Chic., 1946, 42: 1.

The author reports the case of a 50 year old man who had a congenital tumor on the mediovolar side of the two distal phalanges of the left index finger, which had grown some during the 2 or 3 years preceding its removal. There had been no pain nor other disturbance, except that due to the mere presence of the tumor. It was removed by excision, together with an exostosis, and healing was smooth.

On microscopic examination the tumor was found to consist of masses of fibrous connective tissue which surrounded conglomerates of tactile end organs.

The article is complete with photomicrograms, schematic drawings, and detailed discussions of the histologic structure of this tumor.

The author reviews the literature relating to similar structures and concludes that his case is unique in several aspects. Heinrich Lamm, M.D.

DUCTLESS GLANDS

Jones, G. E. S., Delfs, E., and Foote, E. C.: The Effect of Thiouracil Hypothyroidism on Reproduction in the Rat. *Endocrinology*, 1946, 38: 337.

The authors' experiments were planned in an effort to demonstrate what specific effect hypothyroidism might exert on the ability of rats to reproduce. The hypothyroidism was produced with thiouracil because of the difficulty in producing this state surgically in rats.

Fourteen male rats were given approximately 25 mgm. of thiouracil daily by placing the drug in their drinking water and then certain groups were mated after having been fed thiouracil over periods of 49, 166, 204, and 259 days. Three of the animals were obviously ill from other causes and when they were ruled out 10 of the remaining 11 sired the litters. Each rat was mated only a single time with a single female.

There was a tendency toward unsuccessful mating following the one hundred and sixty-sixth day of thiouracil administration which probably reflected the toxicity of the drug rather than any impairment of reproductive capacities.

The results of these experiments on male rats indicate that hypothyroidism, as induced by thiouracil, has no effect upon the reproductive system of the male rat as judged by the ability to sire normal litters.

Thiouracil was then fed in the same manner to 15 female adult rats. The dose was calculated to be 20 mgm. daily. There were 27 matings, 22 of which resulted in resorptions. The 5 litters occurred in the first group of matings, made 84 days after the beginning of thiouracil administration; the remaining 4 matings of this group terminated in resorptions, as did all 18 matings made after the one hundred and twenty-sixth day of thiouracil administration. One interpretation of the findings may be that the matings of the first group reflect a state of borderline hypothyroidism, perhaps comparable to the period of about 3 months described by Engle, which is necessary to dissipate the effect of thyroid feeding in previously thyroidectomized monkeys. Following the time lapse which may be necessary, pregnancy will occur but terminates in resorption in 100 per cent of the cases.

Experiments are now being done in which rats are given thiouracil thyroid extract in order to determine whether the hypothyroidism or the thiouracil causes this effect.

Hypothyroidism induced by thiouracil has no effect upon the reproductive system of the adult male rat as judged by the ability to sire litters. Prolonged thiouracil administration associated with hypothyroidism in the adult female rat does not cause sterility but interferes with continuation of

gestation as it leads to the resorption of embryos in 100 per cent of the cases. If the drug is given over a period of less than 100 days, some rats may deliver litters which are normal in growth and development and reproduce normally.

EDMUND R. DONOGHUE, M.D.

Huggins, C., and Russell, P. S.: Quantitative Effects of Hypophysectomy on Testes and Prostate of Dogs. *Endocrinology*, 1946, 39: 1.

Some of the chemical changes occurring after hypophysectomy in the prostate and testes of dogs are described in this paper. For several reasons, it has become important to study the involution of normal tissues, particularly since the methods which induce regression in them can sometimes be applied to produce dysfunction in neoplastic cells; the endocrine glands, as implied by definition, exert remote control of certain other tissues.

Previous investigations have been directed toward weight and cytology changes and tissue metabolism of the testis after hypophyseal extirpation. The present study deals with quantitative effects produced on the testes and prostate.

Hypophysectomy was done on 4 dogs by the method of Dandy and Reichert under intravenous sodium seconal. The testes were measured through the scrotum preoperatively with a caliper, and dogs with testes of identical size on each side were selected. Hypophyseal removal was judged complete in these animals since no fragments of the sella were found at necropsy and the characteristic regressive changes were found in the adrenals. At the time of hypophysectomy one testis was removed for chemical study and the opposite one was removed when the dogs were sacrificed from 41 to 68 days postoperatively.

In 3 additional dogs, removal of the hypophysis was adjudged incomplete since minute fragments of tissue, identified histologically as pituitary, were found at necropsy.

In 3 normal dogs, a wedge-shaped section of the left lobe of the prostate was removed for phosphatase determination and the testes were then removed; the right lobe of the prostate was assayed at necropsy 2 months later.

All testes were weighed and the content of water, fat, and chloride determined. The acid and alkaline phosphatase content was determined in the hypophysectomized and castrated dogs as well as in 9 normal adult dogs and 3 immature puppies.

In conclusion the authors state that complete hypophysectomy produces slight increase in body weight.

After hypophysectomy, the testicular weight decreases to two-thirds the normal value and is associated with decreased water and increased chloride and fat concentration. The total fat is reduced. There is a dissociation between form and function in the Leydig cells, form and fat content being rather well retained while androgen production is greatly reduced or lost. Spermatogonia persist in the testes, being found in a single layer in the tubules.

Total hypophysectomy produces profound atrophy of the prostatic epithelium which is reduced to the prepuberal state. Prostatic acid phosphatase is decreased below the castrate level to values comparable with those found in juvenile animals. Alkaline phosphatase is decreased to prepuberal levels after hypophysectomy, but is remarkably elevated after castration.

Subtotal hypophysectomy in dogs is associated with prostatic atrophy, but with retention of normal spermatogenesis. EDMUND R. DONOGHUE, M.D.